# OTQ-200G-SR4

## 200 Gb/s QSFP56 SR4 Transceiver

The OTQ-200G-SR4 200G QSFP56 SR4 transceiver is designed for Ethernet 200GBASE-SR4 applications. The module integrates four parallel lanes with baud rate at 26.5625GBd each lane. It can transmit up to 70 m on fiber OM3 fiber or 100 m on OM4 fiber with FEC. It is compliant to IEEE802.3bs, IEEE802.3cd and Common Management Interface Specification Rev4.0.

### FEATURES

- Data rate up to 212.5Gbps (4x PAM4 53Gbps);
- Reach up to 70m on MMF(OM3);
- Reach up to 100m on MMF(OM4);
- 850nm VCSEL laser and PIN receiver;
- High speed I/O electrical interface (200GAUI-4);
- I2C interface with integrated Digital Diagnostic monitoring;
- Single MPO-12 receptacle;
- Single +3.3V power supply;
- Power consumption <5 W;
- Operating case temperature: 0 to +70°C;
- Compliant to RoHS-10

### APPLICATION

- 200GBASE-SR4

### ABSOLUTE MAXIMUM RATINGS (TC=25°C, UNLESS OTHERWISE NOTED)

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 will cause permanent damage and/or adversely affect device reliability.

| Parameter | Symbol | Min | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Storage Temperature | TS | -40 | - | +85 | ºC | |
| Maximum Supply Voltage | Vcc | -0.5 | - | 4.0 | V | |
| Operating Relative Humidity | RH | 15 | - | +85 | % | |

## GENERAL SPECIFICATIONS

| Parameter | Symbol | Min | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Operating Case Temperature | Tc | 0 | - | 70 | ºC | |
| Power Supply Voltage | Vcc | 3.13 | 3.3 | 3.47 | V | |
| Power Supply Current | Icc | - | - | 1.5 | A | |
| Maximum Power Dissipation | $P_D$ | - | - | 5 | W | |
| Lane Baud Rate | $BR_{LANE}$ | | 26.5625 | | GBd | |
| Transmission Distance | TD | | - | 70 | m | Over MMF OM3 |
| Transmission Distance | TD | | - | 100 | m | Over MMF OM4 |

## PIN DESCRIPTIONS

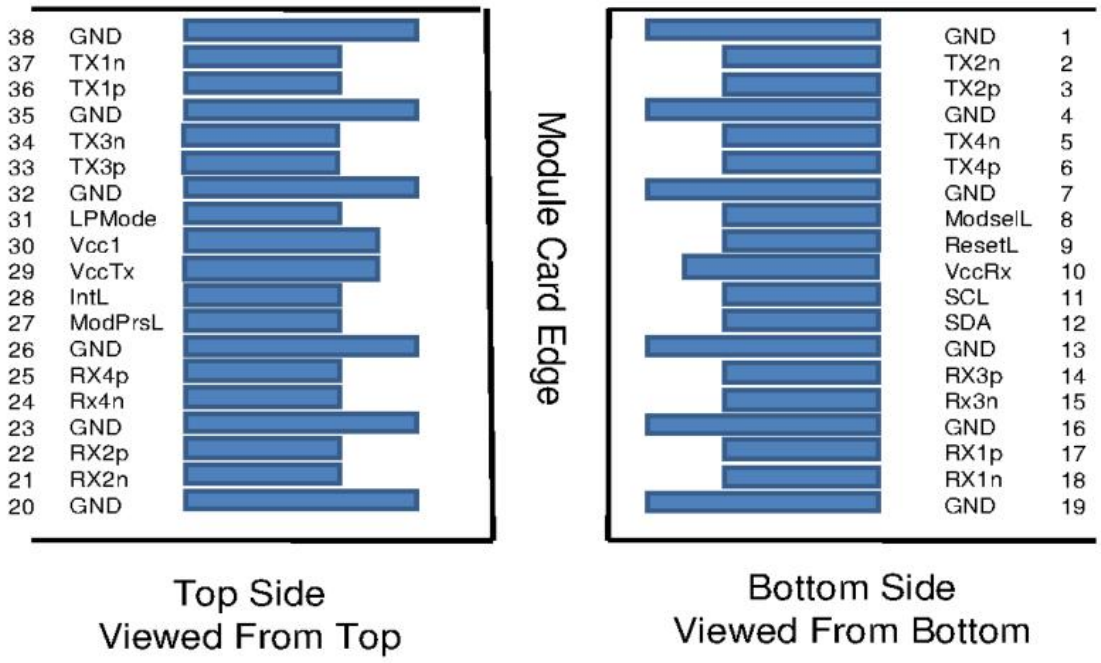



**Figure 1 – Pin Definitions**

## PIN DESCRIPTIONS

| Pin | Symbol | Name/Description | Ref. |
|---|---|---|---|
| 1 | GND | Ground | 1 |
| 2 | Tx2n | Transmitter Inverted Data Input | |
| 3 | Tx2p | Transmitter Non-Inverted Data Input | |
| 4 | GND | Ground | 1 |
| 5 | Tx4n | Transmitter Inverted Data Input | |

| Pin | Symbol | Name/Description | Ref. |
|---|---|---|---|
| 6 | Tx4p | Transmitter Non-Inverted Data Input | |
| 7 | GND | Ground | 1 |
| 8 | ModSelL | Module Select | |
| 9 | ResetL | Module Reset | |
| 10 | Vcc Rx | +3.3 V Power supply receiver | |
| 11 | SCL | 2-wire serial interface clock | |
| 12 | SDA | 2-wire serial interface data | |
| 13 | GND | Ground | 1 |
| 14 | Rx3p | Receiver Non-Inverted Data Output | |
| 15 | Rx3n | Receiver Inverted Data Output | |
| 16 | GND | Ground | 1 |
| 17 | Rx1p | Receiver Non-Inverted Data Output | |
| 18 | Rx1n | Receiver Inverted Data Output | |
| 19 | GND | Ground | 1 |
| 20 | GND | Ground | 1 |
| 21 | Rx2n | Receiver Inverted Data Output | |
| 22 | Rx2p | Receiver Non-Inverted Data Output | |
| 23 | GND | Ground | 1 |
| 24 | Rx4n | Receiver Inverted Data Output | |
| 25 | Rx4p | Receiver Non-Inverted Data Output | |
| 26 | GND | Ground | 1 |
| 27 | ModPrsL | Module Present | |
| 28 | IntL | Interrupt | 2 |
| 29 | Vcc Tx | +3.3 V Power supply transmitter | |
| 30 | Vcc1 | +3.3 V Power Supply | |
| 31 | LPMode | Low Power Mode | |
| 32 | GND | Ground | 1 |
| 33 | Tx3p | Transmitter Non-Inverted Data Input | |
| 34 | Tx3n | Transmitter Inverted Data Input | |
| 35 | GND | Ground | 1 |
| 36 | Tx1p | Transmitter Non-Inverted Data Input | |
| 37 | Tx1n | Transmitter Inverted Data Input | |
| 38 | GND | Ground | 1 |

Notes:

[1] Circuit ground is internally isolated from chassis ground.
[2] IntL is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board. The INTL pin is deasserted "High" after completion of reset, when byte 2 bit 0 (Data Not Ready) is read with a value of '0' and the flag field is read (see SFF-8636).

## ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Min | Typical | Max | Units | Notes |
|---|---|---|---|---|---|---|
| **Receiver electrical output characteristics at TP4** | | | | | | |
| Signaling rate per lane | | | 26.5625 | | GBd | |
| AC common-mode output voltage(RMS) | | | - | 17.5 | mV | |
| Differential peak-to-peak output voltage | | | | 900 | mV | |
| Near-end ESMW (Eye symmetry mask width) | | | 0.265 | | UI | |
| Near-end Eye height, differential | | 70 | | | mV | |
| Far-end ESMW (Eye symmetry mask width) | | | 0.2 | | UI | |
| Far-end Eye height, differential | | 30 | | | mV | |
| Far-end pre-cursor ISI ratio | | -4.5 | | 2.5 | % | |
| Differential output return loss | | 9.5 - 0.37f | | | dB | 0.01 – 8 GHz |
| | | 4.75 -7.4log 10 (f/14) | | | dB | 8 – 19 GHz |
| Common to differential mode conversion return loss | | 22-20(f/25.78) | | | dB | 0.01 - 12.89 GHz |
| | | 15 -6log 10 (f/25.78) | | | dB | 12.89 – 19 GHz |
| Differential termination mismatch | | | | 10 | % | |
| Transition time (min, 20% to 80%) | | 9.5 | | | ps | |
| DC common mode voltage | | -350 | | 2850 | mV | |
| **Transmitter electrical input characteristics at TP1** | | | | | | |
| Signaling rate, per lane | | | 26.5625 | | GBd | |
| Differential pk-pk input voltage tolerance | | 900 | | | mV | |
| Differential input return loss | | 9.5 - 0.37f | | | dB | 0.01 – 8 GHz |
| | | 4.75 -7.4log 10 (f/14) | | | dB | 8 – 19 GHz |
| Differential to common mode input return loss | | 22-20(f/25.78) | | | dB | 0.01 - 12.89 GHz |
| | | 15 -6log 10 (f/25.78) | | | dB | 12.89 – 19 GHz |
| Differential termination mismatch | | | | 10 | % | |
| Module stressed input test | | Per Section 120E.3.4.1, IEEE802.3bs | | | | |
| Single-ended voltage tolerance range | | -0.4 | | 3.3 | V | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Common-mode voltage | | -350 | | 2850 | mV | |

## LOW SPEED CONTROL AND SENSE SIGNALS

| Parameter | Symbol | Min | Max | Unit | Notes/Conditions |
|---|---|---|---|---|---|
| SCL and SDA | VOL | 0 | 0.4 | V | IOL(max)=3.0 mA |
| | VOH | Vcc-0.5 | Vcc+0.3 | V | |
| SCL and SDA | VIL | -0.3 | Vcc*0.3 | V | |
| | VIH | Vcc*0.7 | Vcc + 0.5 | V | |
| Capacitance on SCL and SDA I/O contact. | Ci | | 14 | pF | Looking into the module SCL and SDA contacts. |
| Total bus capacitive load for SCL and SDA for up to 400 kHz SCL rate (includes capacitance of all elements on the bus). | Cb | | 100 | pF | 3.0 kΩ pullup resistor |
| | | | 200 | pF | 1.6 kΩ pullup resistor |
| LPMode/TxDis, ResetL and ModSelL | VIL | -0.3 | 0.8 | V | |
| | VIH | 2 | Vcc+0.3 | V | |
| | Iin | -365 | 125 | μA | 0 V ≤ Vin ≤ Vcc |
| ModPrsL and IntL/RxLOSL | VOL | 0 | 0.4 | V | IOL=2.0mA |
| | VOH | Vcc-0.5 | Vcc+0.3 | V | |

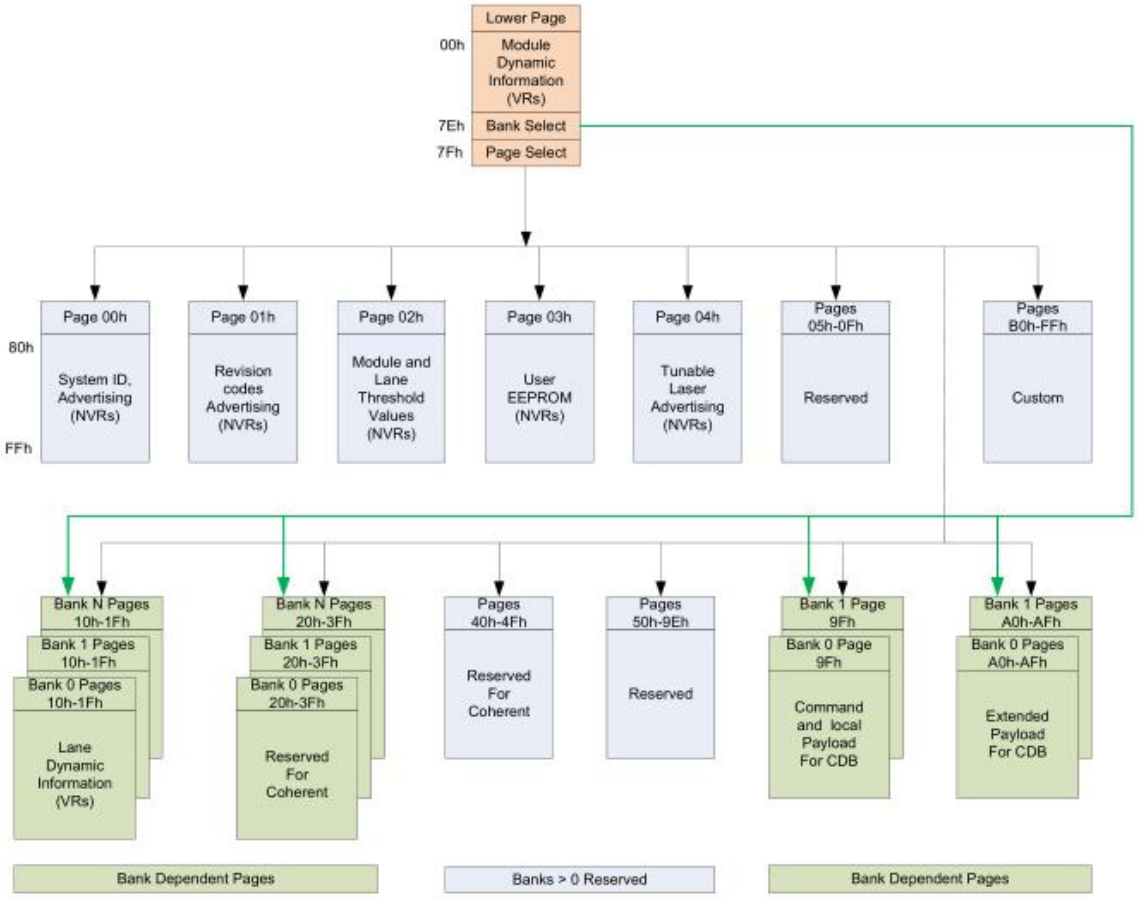
## OPTICAL CHARACTERISTICS

| Parameter | Symbol | Min | Typical | Max | Units | Notes |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| Center Wavelength | λc | 840 | 850 | 860 | nm | |
| RMS Spectral width | Δλ | | | 0.6 | nm | |
| Average Launch Power, each lane | | -6.5 | - | 4 | dBm | |
| Optical Modulation Amplitude | OMA | -4.5 | - | 3 | dBm | |
| Launch power in OMA minus TDEC | | -5.9 | - | - | dBm | |
| Average Output Power (Laser Turn off) | | - | - | -30 | dBm | |
| Side Mode Suppression Ratio | SMSR | 30 | - | - | dB | |
| Extinction Ratio | ER | 3 | - | - | dB | |
| Transmitter and dispersion eye closure | TDEC | - | - | 4.5 | dB | |
| TDECQ – 10log $_{10}$ ($C_{eq}$ ), each lane | | | | 4.5 | dB | |
| Optical Return Loss Tolerance | ORLT | - | - | 12 | dB | |
| $RIN_{12}$ OMA | | | | -128 | dB/Hz | |
| Encircled flux at 4.5 μ m | | | | 30 | % | |
| Encircled flux at 19 μ m | | 86 | | | % | |
| **Receiver** | | | | | | |
| Center Wavelength | λc | 840 | 850 | 860 | nm | |

| Parameter | Symbol | Min | Typical | Max | Units | Notes |
|---|---|---|---|---|---|---|
| Damage threshold | | 5 | - | - | dBm | |
| Average receive power, each lane | | -8.4 | | 4 | dBm | |
| Receive power, each lane (OMAouter) | | | - | -3 | dBm | 1 |
| Receiver sensitivity (OMAouter), each lane | Rx_sen | | | max( -6.5, SECQ-7.9) | dBm | 1 |
| Stressed receiver sensitivity (OMAouter), each lane | | - | - | -3.4 | dBm | 2 |
| Reflectance | Ref | - | - | -12 | dB | |
| LOS Assert | $LOS_A$ | -20 | - | - | dBm | |
| LOS De-Assert | $LOS_D$ | - | - | -7.5 | dBm | |
| LOS Hysteresis | $LOS_H$ | 0.5 | - | 5 | dB | |

Notes:
[1] Measured at TP3 for BER 2.4E-4 Pre-FEC
[2] Conditions of stressed receiver sensitivity test:
Stressed eye closure for PAM4 (SECQ), lane under test=4.5dB
SECQ – $10\log_{10}(C_{eq})$ (max) , lane under test =4.5dB
OMA of each aggressor lane =3dBm

**Module Memory Map**



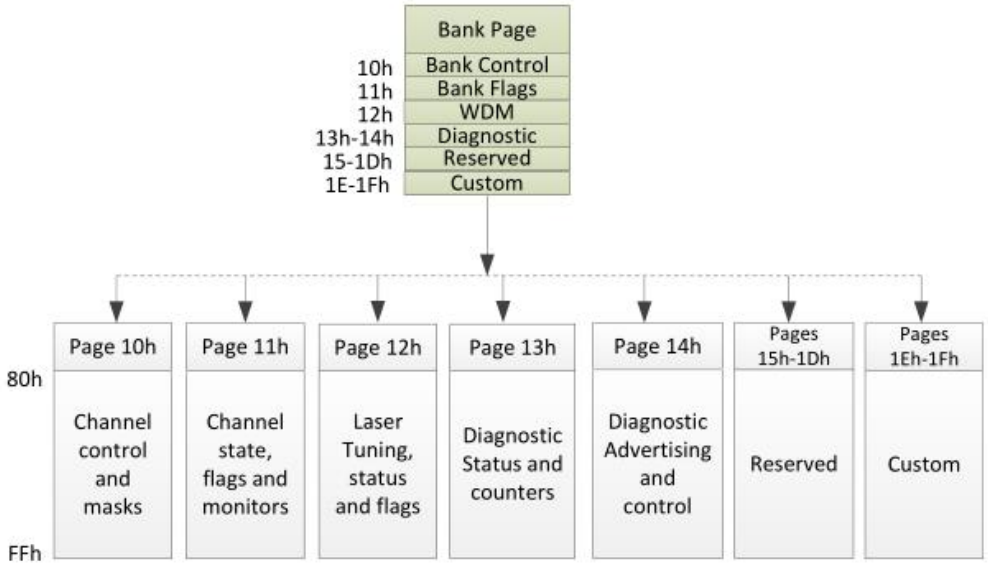



**Figure 2 –Memory Map**

## DIGITAL DIAGNOSTIC SPECIFICATION

| Parameter | Symbol | Accuracy | Units | Notes |
|---|---|---|---|---|
| Transceiver Case Temperature | DMI_TEMP | ±3 | ℃ | Over operating temp |
| Supply voltage monitor absolute error | DMI _VCC | ±3% | V | Full operating range |
| Channel Bias current monitor | DMI_IBIAS | ±3% | mA | Per channel |
| Channel RX power monitor absolute error | DMI_RX | ±3 | dB | Per channel |
| Channel TX power monitor absolute error | DMI_TX | ±3 | dB | Per channel |

## OPTICAL INTERFACE LANES AND ASSIGNMENT

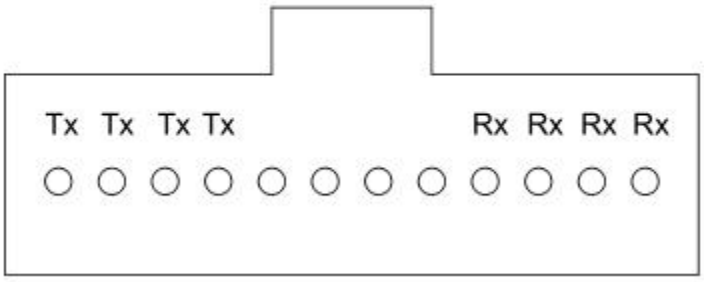



**Figure 3 –Optical lanes Assignment**

To minimize MPO connection induced reflections, an MPO receptacle with 8-degree angled end-face is utilized for this product.

## MECHANICAL SPECIFICATIONS

unit：mm

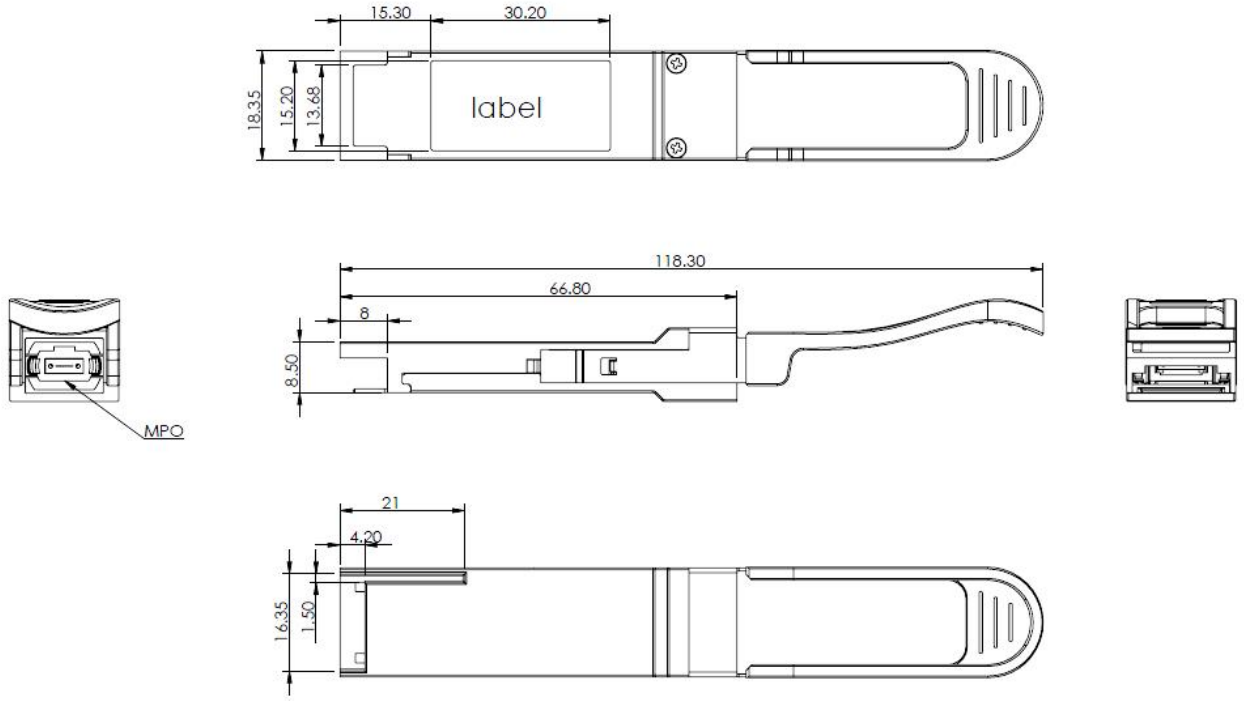



**Figure 4 – QSFP56 Mechanical Specifications**

## ORDERING INFORMATION

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|---|
| OTQ-200G-SR4 |

## ESD SAFETY CAUTIONS

This transceiver is specified as ESD threshold 1KV for high speed data pins and 2KV for all others electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.