## Features:

- QSFP56 MSA compliant

- 4 parallel lanes on 850nm center wavelength

- Compliant to IEEE 802.3bs Specification

- Up to 70m transmission on OM3, 100m on OM3 with FEC or 100m on OM4

- Operating case temperature: 0 to 70$^{\circ}$C

- 4x53.125Gb/s electrical interface (200GAUI-4)

- Data Rate 53.125Gbps (PAM4) per channel.

- Maximum power consumption 5W

- MPO-12 APC connector

- RoHS compliant

## Applications:

- Data Center Interconnect

- 200G Ethernet

- Infiniband interconnects

- Enterprise networking

## 1. Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Storage Temperature | TS | -40 | 85 | degC |
| Operating Case Temperature | TOP | 0 | 70 | degC |
| Power Supply Voltage | VCC | -0.5 | 3.6 | V |
| Relative Humidity (non-condensation) | RH | 0 | 85 | % |

Note: Operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

## 2. Recommended Operating Conditions

| Parameter | Symbol | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Operating Case Temperature | TOP | 0 | | 70 | $^{deg}$C | |
| Power Supply Voltage | VCC | 3.135 | 3.3 | 3.465 | V | |
| Data Rate, each Lane | | | 26.5625 | | GBd | PAM4 |
| Data Rate Accuracy | | -100 | | 100 | ppm | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Pre-FEC Bit Error Ratio | | | | 2.4x10-4 | | |
| Post-FEC Bit Error Ratio | | | | 1x10-12 | | 1 |
| Link Distance with OM3 | D | 0.5 | | 100 | m | 2 |

**Notes:**

1. FEC provided by host system.
2. FEC required on host system to support maximum distance.

## 3. Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

| Parameter | Test Point | Min | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| Power Consumption | | | | 5 | W | |
| Supply Current | Icc | | | 1.52 | A | |
| **Transmitter (each Lane)** | | | | | | |
| Signaling Rate, each Lane | TP1 | 26.5625 ± 100 ppm | | | GBd | |
| Differential pk-pk Input Voltage Tolerance | TP1a | 900 | | | mVpp | 1 |
| Differential Termination Mismatch | TP1 | | | 10 | % | |
| Differential Input Return Loss | TP1 | IEEE 802.3-2015 Equation (83E-5) | | | dB | |
| Differential to Common Mode Input Return Loss | TP1 | IEEE 802.3-2015 Equation (83E-6) | | | dB | |
| Module Stressed Input Test | TP1a | See IEEE 802.3bs 120E.3.4.1 | | | | 2 |
| Single-ended Voltage Tolerance Range (Min) | TP1a | -0.4 to 3.3 | | | V | |
| DC Common Mode Input Voltage | TP1 | -350 | | 2850 | mV | 3 |
| **Receiver (each Lane)** | | | | | | |
| Signaling Rate, each lane | TP4 | 26.5625 ± 100 ppm | | | GBd | |
| Differential Peak-to-Peak Output Voltage | TP4 | | | 900 | mVpp | |
| Common Mode Voltage | | -350 | | 2850 | mV | |
| AC Common Mode Output Voltage, RMS | TP4 | | | 17.5 | mV | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Differential Termination Mismatch | TP4 | | | 10 | % | |
| Differential Output Return Loss | TP4 | IEEE 802.3-2015 Equation (83E-2) | | | | |
| Common to Differential Mode Conversion Return Loss | TP4 | IEEE 802.3-2015 Equation (83E-3) | | | | |
| Transition Time, 20% to 80% | TP4 | 9.5 | | | ps | |
| Near-end Eye Symmetry Mask Width (ESMW) | TP4 | | 0.265 | | UI | |
| Near-end Eye Height, Differential | TP4 | 70 | | | mV | |
| Far-end Eye Symmetry Mask Width (ESMW) | TP4 | | 0.2 | | UI | |
| Far-end Eye Height, Differential | TP4 | 30 | | | mV | |
| Far-end Pre-cursor ISI Ratio | TP4 | -4.5 | | 2.5 | % | |
| Common Mode Output | | | | | | |
| Voltage (Vcm) | TP4 | -350 | | 2850 | mV | 3 |

**Notes:**
1. With the exception to IEEE 802.3bs 120E.3.1.2 that the pattern is PRBS31Q or scrambled idle.
2. Meets BER specified in IEEE 802.3bs 120E.1.1.
3. DC common mode voltage generated by the host. Specification includes effects of ground offset voltage.

## 4. Optical Characteristics

| Parameter | Symbol | Min | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| Center Wavelength | λC | 840 | 850 | 860 | nm | |
| Data Rate, each Lane | | 26.5625 ± 100 ppm | | | GBd | |
| Modulation Format | | PAM4 | | | | |
| RMS Spectral Width | Δλrms | | | 0.6 | nm | Modulated |
| Average Launch Power, each Lane | PAVG | -6.5 | | 4 | dBm | 1 |
| Outer Optical Modulation Amplitude (OMAouter), each Lane | POMA | -4.5 | | 3 | dBm | 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Launch Power in OMAouter minus TDECQ, each Lane | | -5.9 | | | dB | |
| Transmitter and Dispersion | | | | | | |
| Eye Closure for PAM4, each Lane | TDECQ | | | 4.5 | dB | |
| Extinction Ratio | ER | 3 | | | dB | |
| Optical Return Loss Tolerance | TOL | | | 12 | dB | |
| Average Launch Power of | | | | | | |
| OFF Transmitter, each Lane | Poff | | | -30 | dBm | |
| Encircled Flux | | ≥ 86% at 19 μm<br>≤ 30% at 4.5 μm | | | | |
| **Receiver** | | | | | | |
| Center Wavelength | λC | 840 | 850 | 860 | nm | |
| Data Rate, each Lane | | 26.5625 ± 100 ppm | | | GBd | |
| Modulation Format | | PAM4 | | | | |
| Damage Threshold, each Lane | THd | 5 | | | dBm | 3 |
| Average Receive Power, each Lane | | -8.4 | | 4 | dBm | 4 |
| Receive Power (OMAouter), each Lane | | | | 3 | dBm | |
| Receiver Sensitivity (OMAouter), each Lane | SEN | | | Equation1 | dBm | 7 |
| Stressed Receiver Sensitivity (OMAouter), each Lane | SRS | | | -3.4 | dBm | 5 |
| Receiver Reflectance | RR | | | -12 | dB | |
| LOS Assert | LOSA | -30 | | | dBm | |
| LOS De-assert | LOSD | | | -12 | dBm | |
| LOS Hysteresis | LOSH | 0.5 | | | dB | |
| **Stressed Conditions for Stress Receiver Sensitivity (Note 7)** | | | | | | |
| Stressed Eye Closure for PAM4 (SECQ), Lane under Test | | | 4.5 | | dB | |
| SECQ – 10log10(Ceq)f (max), lane under test | | | 4.5 | | dB | |
| OMAouter of each Aggressor | | | | | | |
| Lane | | | 3 | | dBm | |

**Notes:**
1. Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
2. Even if the TDECQ < 1 dB , the OMAouter (min) must exceed the minimum value specified here.
3. The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level.

4.  Average receive power, each lane (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
5.  Measured with conformance test signal at receiver input for the BER of 2.4x10-4.
6.  These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.
7.  Receiver sensitivity Receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 4.5 dB. Receiver sensitivity should meet Equation (1), which is illustrated in Figure 1.
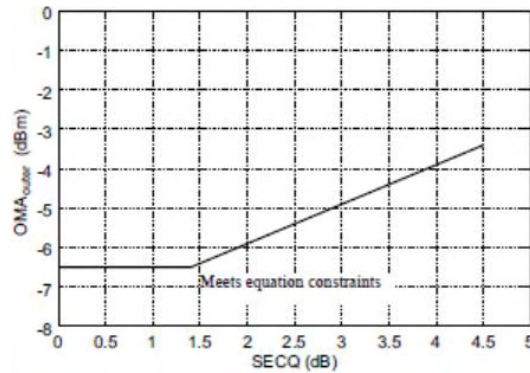
$$RS = max(-6.5, SECQ - 7.9) \text{ (dBm) (Equation 1)}$$
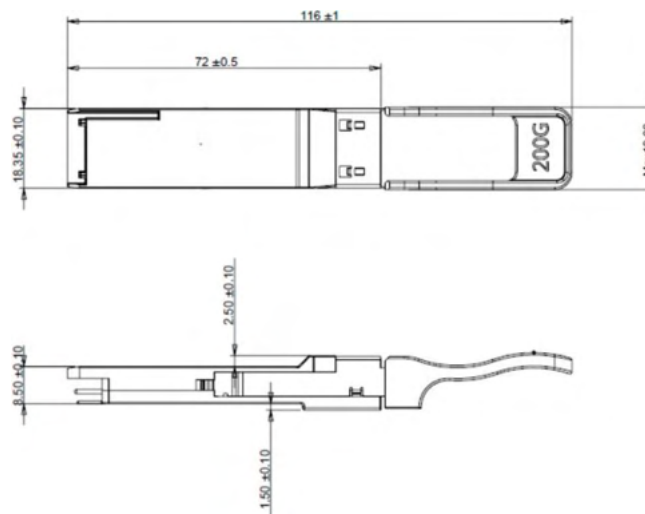
where

RS            is the receiver sensitivity

SECQ        is the SECQ of the transmitter used to measure the receiver sensitivity

The normative requirement for receivers is stressed receiver sensitivity.



## 5. Mechanical Diagram



**Note:** External physical characteristics are subject to variation. This may include, but is not limited to, external case designs, pull tab colors and/or shapes, removal latch styles or colors, and label sizes and placement. These variations do not affect the function or characteristics of the transceivers.

## 6. Ordering Information

| PNY Part Number | Mellanox Legacy PN | Product Description |
|---|---|---|
| PMA1L10-CR | NVIDIA/Mellanox | 100% Mellanox Compatible optical transceiver, 100GbE, 100Gb/s, QSFP28, LC-LC, 1310nm, LR 4 up to 10km |

## 7. Contact Information

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