# 400G OSFP SR4 Optical Transceiver

## Features

- Up to 50Gbps data rate per channel by PAM4 modulation
- Hot-pluggable OSFP form factor
- Maximum link length of 50m on OM4 fiber with FEC
- +3.3V single power supply
- Power dissipation < 9W
- Operating case temp Commercial: 0°C to +70 °C
- MPO-12 APC connector
- RoHS compliant
- Pre-FEC BER ≤ 1E-8 in the switcher epupment
- self-loopback test

## Application

- Application case 1, 1x400G VR4, 1 of 400G per port point to point connections
- Application case 2, 4x100G VR, 4 of 100G per channel breakout connections

## Order Information

### Table 1-Order Information

| Part No. | Bit Rate (Gbps) | Laser (nm) | Distance note1 | Fiber Type | DDMI | Connector | Tempnote2 |
|---|---|---|---|---|---|---|---|
| 400G OSFP SR4 | 425.0 | 850 | 50m | MMF | YES | MPO 1x12 APC | 0°C~+70°C |

**Note:**
**1.OM4 fiber, 30m for OM3 fiber, with FEC**
**2.Case Temperature**

## Absolute Maximum Ratings

### Table2- Absolute Maximum Ratings

| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
|---|---|---|---|---|---|---|
| Supply Voltage | Vcc3 | -0.5 | - | +3.6 | V | |
| Storage Temperature | Ts | -40 | - | +85 | ° C | |
| Operating Humidity | RH | 0 | - | +85 | % | 1 |
| Control Input Voltage | VI | -0.3 | - | VCC+0.5 | V | 1 |

**Note:1 No condensation**

## Recommended Operating Conditions

### Table 3- Recommended operating Conditions

| Parameter | Symbol | Min. | Typical | Max. | Unit | Notes |
|---|---|---|---|---|---|---|
| Operating Case Temperature | TC | 0 | - | +70 | ° C | |
| Power Supply Voltage | Vcc | 3.135 | 3.3 | 3.465 | V | |
| Power Dissipation | Pd | - | - | 9 | W | |
| Supply Current | Icc | - | - | 2870 | mA | |
| Pre-FEC Bit Error Ratio | - | - | - | 2.4x10-4 | - | |
| Post-FEC Bit Error Ratio | - | - | - | 1x10-12 | - | 1 |
| Link Distance (OM4) | - | 2 | - | 50 | m | 2 |
| Link Distance (OM3) | - | 2 | - | 30 | m | |

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

## Electrical Characteristics

### Table 4- Electrical Characteristics

| Parameter | Symbol | Unit | Min | Typ | Max | Notes |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| Signaling Rate per Lane | SR | Gbd | 53.125 ± 100 ppm | | | |
| Modulation format | - | - | PAM4 | | | |
| Differential pk-pk input Voltage tolerance | Vin,pp,diff | mV | 750 | - | - | |
| Peak-to-peak AC common-mode voltage tolerance Low-frequency Full-band | VCMLF<br>VCMFB | mV | 32<br>80 | - | - | |
| Differential-mode to common-mode return loss | RLcd | dB | IEEE 803.3ck Equation (120G-2 ) | - | - | |
| Module stressed input tolerance | - | - | IEEE802.3ck 120G.3.4.3 | | | |
| Effective return loss | ERL | dB | 8.5 | | | |
| Differential termination mismatchal | - | % | - | - | 10 | |
| Single-ended voltage tolerance range | - | V | -0.4 | - | 3.3 | |
| DC common-mode voltage tolerance Upper limit Lower limit | - | mV | 2850<br>-350 | | | |
| **Receiver** | | | | | | |
| Signaling Rate per Lane | SR | Gbd | 53.125 ± 100 ppm | | | |
| Modulation format | - | - | PAM4 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Peak-to-peak AC common-mode voltage Low-frequency Full-band | VCMLF VCMFB | mV | - | - | 32 80 | |
| Differential output Voltage (Long mode) | - | mV | - | - | 845 | |
| Differential output Voltage (Short mode) | - | mV | - | - | 600 | |
| Eye height | - | mV | 15 | - | - | |
| Vertical eye closure | VEC | mV | - | - | 12 | |
| Common-mode to differential-mode return loss | RLdc | dB | IEEE 803.3ck Equation (120G-1 ) | - | - | |
| Differential Termination Mismatch | - | % | - | - | 10 | |
| Transition Time | - | ps | 8.5 | - | - | |
| DC common mode Voltage tolerance Upper limit Lower limit | - | mV | 2850 -350 | | | |

**Table 5-Optical Characteristics**

| Parameter | Symbol | Unit | Min | Typ | Max | Notes |
|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | |
| Signaling Rate per Lane | SR | Gbd | 53.125 ± 100 ppm | | | |
| Modulation format | - | - | PAM4 | | | |
| Center wavelength | CW | nm | 842 | - | 948 | |
| RMS Spectral Width | SW | dBm | - | - | 0.65 | 1 |
| Average Launch Power per Lane | AOP | dBm | -4.6 | - | 4.0 | |
| Outer Optical Modulation Amplitude (OMAouter), each lane (min) For max(TECQ,TDECQ)≤1.8dB For 1.8<max(TECQ,TDECQ)≤4.4dB | TxOMA | dBm | -2.6 -4.4+max(TECQ, TDECQ) | - | 3.5 | |
| Transmitter and Dispersion Eye Closure for PAM4 (TDECQ), each lane | TDECQ | dB | - | - | 4.4 | |
| Transmitter eye closure for PAM4,each lane | TECQ | dB | - | - | 4.4 | |
| Overshoot/undershoot | - | % | - | - | 29 | |
| Transimitter power excursion,each lane | - | dBm | - | - | 2.3 | |
| Transition Time | Tt | ps | - | - | 17 | |
| Average Launch Power of OFF Transmitter, each lane | TOFF | dBm | - | - | -30 | |
| RIN14OMA | RIN | dB/Hz | - | - | -132 | |
| Extinction Ratio, each lane | ER | dB | 2.5 | - | - | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Optical Return Loss Tolerance | ORL | dB | - | - | 14 | |
| Encircled flux | - | dBm | ≥86% at 19 μ m<br>≤30% at 4.5 μ m | | | 2 |
| **Receiver** | | | | | | |
| Signaling Rate per Lane | SR | Gbd | 53.125 ± 100 ppm | | | |
| Modulation format | - | - | PAM4 | | | |
| Wavelength | W | nm | 842 | - | 948 | |
| Damage Threshold, average optical power, each lane | DT | dBm | 5 | - | - | 3 |
| Average Receive Power, each lane | RXPx | dBm | -6.3 | - | 4 | 4 |
| Receive Power (OMA) per Lane | RxOMA | dBm | - | - | 3.5 | |
| Receiver Reflectance | Rfl | dB | - | - | -15 | |
| Receiver Sensitivity (OMAouter), each lane For TECQ≤1.8dB For 1.8<TECQ ≤4.4dB | SEN | dBm | - | - | -4.4<br>-6.2+TECQ | 5 |
| LOS Assert | LOSA | dBm | -15 | - | - | |
| LOS De-assert | LOSD | dBm | - | - | -9.2 | |
| LOS Hysteresis | LOSH | dB | 0.5 | - | - | |
| OMAouter of each aggressor lane | - | dBm | - | 3.5 | - | |

**Note:**
**1. RMS spectral width is the standard deviation of the spectrum**
**2. If measured into type A1a.2 or type A1a.3, or A1a.4, 50 μm fiber, in accordance with IEC 61280-1-4**
**3. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power**
**4. Average receive power, each lane (min) is informative and not the principal indicator of signal strength.**
**5. A received power below this value cannot be compliant; however, a value above this does not ensure Receiver sensitivity (OMAouter) is informative and is defined for a transmitter with a value of TECQ up to 4.4 dB**

## Digital Diagnostic Specifications

### Table 6-Digital Diagnostic Characteristics

| Parameter | Symbol | Unit | Min | Max | Notes |
|---|---|---|---|---|---|
| Temperature monitor absolute error | DMI_Temp | degC | -3 | 3 | Over operating temperature range |
| Supply voltage monitor absolute error | DMI _VCC | V | -0.1 | 0.1 | Over full operating range |
| Channel RX power monitor absolute error | DMI_RX_Ch | dB | -3 | 3 | 1 |
| Channel Bias current monitor | DMI_Ibias_Ch | mA | -10% | 10% | |
| Channel TX power monitor absolute error | DMI_TX_Ch | dB | -3 | 3 | 1 |

**Notes:**
**1. Due to measurement accuracy of different multi-mode fibers, there could be an additional**
**2. +/-1 dB fluctuation, or a +/- 3 dB total accuracy**

## Recommended Interface

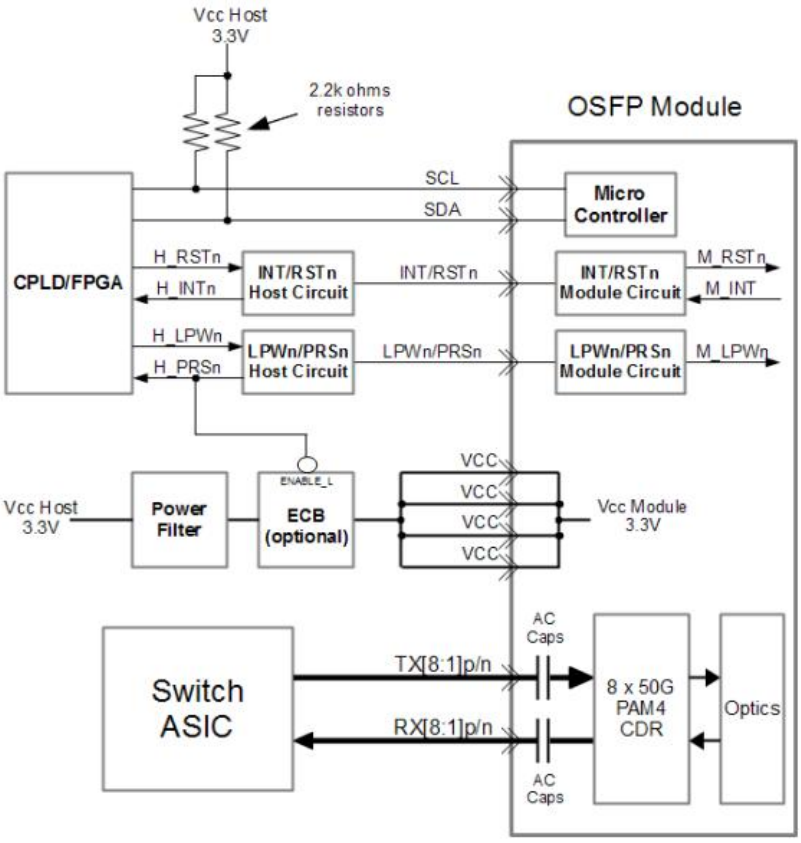


**Figure 1, Recommended Interface Circuit**

## Pin arrangement

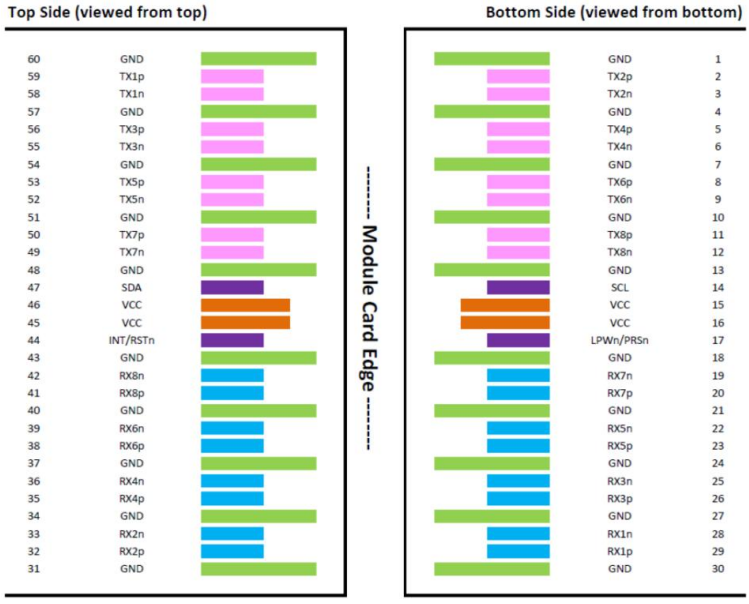


**Figure 2, Pin View**

Table 7-Pin Function Definitions

| Pin# | Symbol | Description | Logic | Direction | Plug Sequence | Notes |
|---|---|---|---|---|---|---|
| 1 | GND | Ground | | | 1 | |
| 2 | TX2p | Transmitter Data Non-Inverted | CML-1 | nput from Host | 3 | |
| 3 | TX2n | Transmitter Data Inverted | CML-1 | nput from Host | 3 | |
| 4 | GND | Ground | | | 1 | |
| 5 | TX4p | Transmitter Data Non-Inverted | CML-1 | nput from Host | 3 | |
| 6 | TX4n | Transmitter Data Inverted | CML-1 | nput from Host | 3 | |
| 7 | GND | Ground | | | 1 | |
| 8 | TX6p | Transmitter Data Non-Inverted | CML-1 | nput from Host | 3 | |
| 9 | TX6n | Transmitter Data Inverted | CML-1 | nput from Host | 3 | |
| 10 | GND | Ground | | | 1 | |
| 11 | TX8p | Transmitter Data Non-Inverted | CML-1 | nput from Host | 3 | |
| 12 | TX8n | Transmitter Data Inverted | CML-1 | nput from Host | 3 | |
| 13 | GND | Ground | | | 1 | |
| 14 | SCL | 2-wire Serial interface dock | LVCMOS-/0 | Bi-directional | 3 | Open-Drain with pull-up resistor on Host |
| 15 | VCC | +3.3V Power | | Power from Host | 2 | |
| 16 | VCC | +3.3V Power | | Power from Host | 2 | |
| 17 | LPWn/PRSn | Low-Power Mode/Module Present | Multi-Level | Bi-directional | 3 | See pin description for required circuit |
| 18 | GND | Ground | | | 1 | |
| 19 | RX7n | Receiver Data Inverted | CML-0 | Output to Host | 3 | |
| 20 | RX7p | Receiver Data Non-Inverted | CML-0 | Output to Host | 3 | |
| 21 | GND | Ground | | | 1 | |
| 22 | RX5n | Receiver Data Inverted | CML-0 | Output to Host | 3 | |
| 23 | RX5p | Receiver Data Non-Inverted | CML-O | Output to Host | 3 | |
| 24 | GND | Ground | | | 1 | |
| 25 | RX3n | Receiver Data Inverted | CML-0 | Output to Host | 3 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 26 | RX3p | Receiver Data Non-Inverted | CML-0 | Output to Host | 3 | |
| 27 | GND | Ground | | | 1 | |
| 28 | RX1n | Receiver Data Inverted | CML-0 | Output to Host | 3 | |
| 29 | RX1p | Receiver Data Non-Inverted | CML-0 | Output to Host | 3 | |
| 30 | GND | Ground | | | 1 | |
| 31 | GND | Ground | | | 1 | |
| 32 | RX2p | Receiver Data Non-Inmverted | CML-0 | Output to Host | 3 | |
| 33 | RX2n | Receiver Data Inverted | CML-0 | Output to Host | 3 | |
| 34 | GND | Ground | | | 1 | |
| 35 | RX4p | Receiver Data Non-Inmverted | CML-0 | Output to Host | 3 | |
| 36 | RX4n | Receiver Data Inverted | CML-0 | Output to Host | 3 | |
| 37 | GND | Ground | | | 1 | |
| 38 | RX6p | Receiver Data Non-Imverted | CML-0 | Output to Host | 3 | |
| 39 | RX6n | Receiver Data Inverted | CML-0 | Output to Host | 3 | |
| 40 | GND | Ground | | | 1 | |
| 41 | RX8p | Receiver Data Non-Imverted | CML-0 | Output to Host | 3 | |
| 42 | RX8n | Receiver Data Inverted | CML-0 | Output to Host | 3 | |
| 43 | GND | Ground | | | 1 | |
| 44 | NT/RSTn | Module Interrupt/Module Reset | Multi-Level | Bi-directional | 3 | See pin description or required circuit |
| 45 | VCC | +3.3V Power | | Powerfrom Host | 2 | |
| 46 | VcC | +3.3V Power | | Power from Host | 2 | |
| 47 | SDA | 2-wire Serial interfacedata | LVCMOS-1/0 | Bi-directional | 3 | Open-Drain with pull-up resistor on Host |
| 48 | GND | Ground | | | 1 | |
| 49 | TX7n | Transmitter Data lmverted | CML- | nputfrom Host | 3 | |
| 50 | TX7p | Transmitter Data Non-Inverted | CML- | nputfrom Host | 3 | |
| 51 | GND | Ground | | | 1 | |
| 52 | TX5n | Transmitter Data Inverted | CML- | nputfrom Host | 3 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 53 | TXSp | Transmitter Data Non-Inverted | CML- | nputfrom Host | 3 | |
| 54 | GND | Ground | | | 1 | |
| 55 | TX3n | Transmitter Data lmverted | CML- | nputfrom Host | 3 | |
| 56 | TX3p | Transmitter Data Non-Inverted | CML- | nputfrom Host | 3 | |
| 57 | GND | Ground | | | 1 | |
| 58 | TXIn | Transmitter Data Inverted | CML- | nputfrom Host | 3 | |
| 59 | TX1p | Transmitter Data Non-Inverted | CML- | nputfrom Host | 3 | |
| 60 | GND | Ground | | | 1 | |

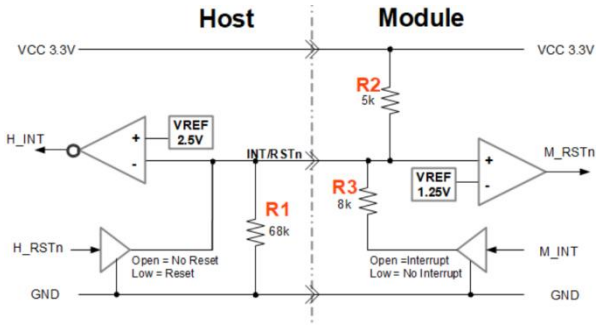


**Figure 2,INT/RSTn circuit**

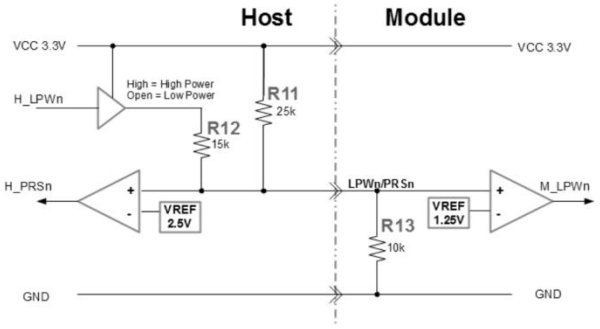


**Figure 3,LPWn/PRSn circuit**

## Memory Map

Compatible with CMIS rev 5.2.

## Opticalinterface arrangement

The optical port is a male MPO connector receptacle, with fiber lane assignments as shown in Figure 3

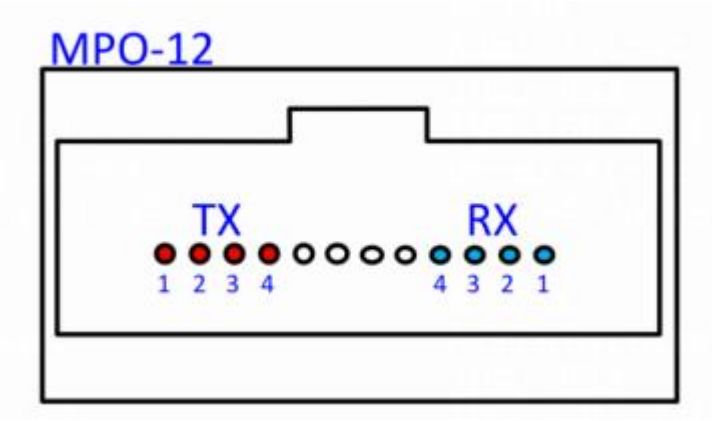


**Figure 3,Optical interface arrangement.**

## Mechanical

400G SR4 OSFP transceivers are compatible with OSFP Module Specification Rev5.0 for pluggable form factor module.

**Unit mm**