DRIVENETS

DATASHEET

OPTICAL TRANSCEIVER · OSFP112 RIDING HEAT SINK

# DriveNets 400G DR4

OSFP112 transceiver with an MPO-12 interface and a riding heat sink, delivering 4 × 106.25 Gbps PAM4 over single-mode fiber for 400GbE switch, router and AI cluster interconnect.

**400 Gbps**

AGGREGATE LINE RATE

4 × 106.25G PAM4

MPO-12 · 500 m

9 W maximum




## OVERVIEW

The DriveNets 400G OSFP112 DR4 is a small-form-factor, hot-pluggable optical transceiver designed to transmit and receive serial optical data links up to 106.25 Gbps per channel using PAM4 modulation over single-mode fiber. It integrates a high-performance SiP modulator and PD detectors with a riding heat sink (RHS) in an OSFP112 form factor. Four lanes at 1304.5 - 1317.5 nm (1311 nm typical) are presented on an MPO-12 interface with an 8° APC endface, giving 400 Gbps of aggregate capacity at reaches up to 500 m. The module is compliant with 400G Ethernet specifications and the OSFP112 MSA, and is managed per OIF-CMIS over a 2-wire serial interface. Maximum power consumption is 9 W across a 0 °C to +70 °C case-temperature range, for 400GBASE-DR4 Ethernet and InfiniBand, switch and router connections, datacenters and AI clusters, and other 400G interconnect.

### Optical interface

MPO-12, 8° APC · 4 lanes at 106.25 Gbps PAM4

1304.5 - 1317.5 nm · 500 m over single-mode fiber

Class 1 laser product per IEC 60825-1

### Electrical & management

60-contact edge connector · OSFP MSA rev 5.0

2-wire serial (SCL / SDA) · OIF-CMIS rev 5.2 or later Electrical per IEEE 802.3ck

### Power & environmental

9 W maximum power consumption

0 °C to +70 °C case · riding heat sink (RHS)

RoHS II 2011/65/EU · digital diagnostics monitoring

HARDWARE SPECIFICATION

# Key specifications

### Ordering & package

| | |
|---|---|
| Part number | **DNOT00021** |
| Form factor | **OSFP112 RHS** |
| Optical interface | **MPO-12, 8° APC** |
| Data rate | **400G (4 × 106.25 Gbps PAM4)** |
| Reach | **500 m single-mode fiber** |

### Electrical

| | |
|---|---|
| Supply voltage (VCC) | **3.135 – 3.465 V** |
| Baud rate per channel | **53.125 GBd ±100 ppm** |
| Power consumption | **9 W maximum** |
| Input voltage tolerance | **750 mVpp min** |
| Output voltage, short / long | **600 / 845 mVpp max** |
| Eye height / VEC | **15 mV min / 12 dB max** |

### Optical – transmitter

| | |
|---|---|
| Modulation format | **PAM4** |
| Center wavelength | **1304.5 – 1317.5 nm (1311 nm typ.)** |
| Output power (PAVG) | **-2.9 to 4 dBm** |
| OMAouter | **-0.8 to 4.2 dBm** |
| Extinction ratio | **3.5 dB min** |
| TDECQ | **3.4 dB max** |
| Side-mode suppression | **30 dB min** |

### Environmental

| | |
|---|---|
| Operating case temp | **0 °C – +70 °C** |
| Storage temperature | **-40 °C – +85 °C** |
| Relative humidity | **5% – 85%** |
| VCC absolute maximum | **-0.3 V – +3.6 V** |
| Cooling | **Riding heat sink (RHS)** |

### Optical – receiver

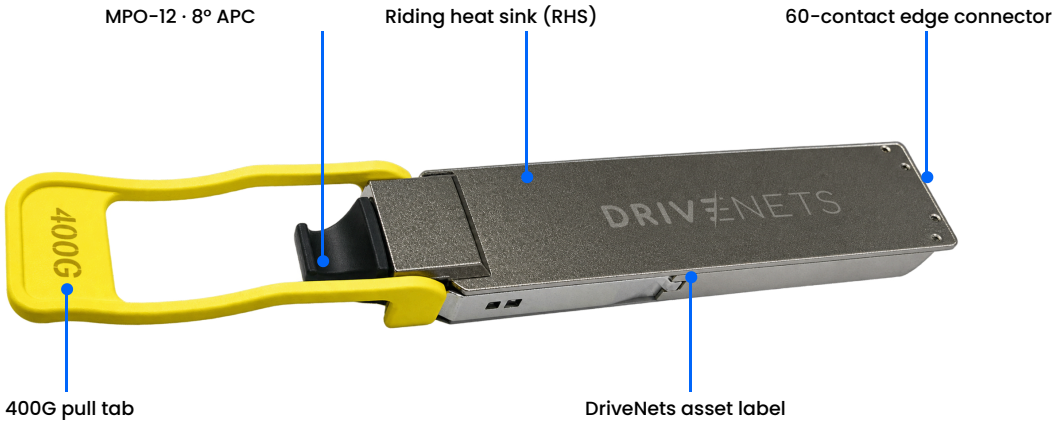
| | |
|---|---|
| Average receive power | **-5.9 to 4 dBm** |
| Sensitivity (OMAouter) | **-3.9 dBm @ 2.4E-4** |
| Stressed sensitivity | **-1.9 dBm** |
| Damage threshold | **5 dBm** |
| Receiver reflectance | **-26 dB max** |

### Management

| | |
|---|---|
| Host interface | **60-contact edge connector** |
| Control | **2-wire serial (SCL / SDA)** |
| Memory map | **OIF-CMIS Rev 5.2 or later** |

INTERFACE OVERVIEW

# Module layout




REGULATORY COMPLIANCE

# Certifications

### EMC

FCC 47 CFR Part 15, Class B

EN 55032:2015+A11:2020+A1:2020

EN 55035:2017+A11:2020

IEC 61000-4-3:2020

IEC EN 61000-4-2:2008

### Product safety

CB: IEC 62368-1:2018

TÜV Mark: EN IEC 62368-1:2020+A11

UL Recognized Component: UL 62368-1:2019 R10.21, CSA C22.2 No. 62368-1:19

### Optical & environmental

Class 1 laser product

FDA/CDRH

IEC 60825-1:2014

IEC 60825-2:2021

EN 60825-1:2014+A11

Complies with RoHS II Directive 2011/65/EU

**400 Gbps**
AGGREGATE LINE RATE

**4 × 106G**
PAM4 LANES

**500 m**
REACH OVER SMF

**9 W**
MAXIMUM POWER

APPLICATIONS & STANDARDS

### Applications

- 400GBASE-DR4 Ethernet & InfiniBand
- Switch & router connections
- Datacenters & AI clusters
- Other 400G interconnect

### Reference documents

- OIF common management interface specification (CMIS) rev 5.2 or later
- OSFP MSA Rev 5.0
- IEEE Std 802.3ck™/D3.0
- IEEE Std 802.3df

RATINGS

# Absolute maximum ratings

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|---|---|---|---|---|
| Storage temperature range | $T_S$ | **-40** | **+85** | °C |
| Relative humidity | RH | **5** | **85** | % |
| Power supply voltage | $V_{CC}$ | **-0.3** | **+3.6** | V |

1. Absolute maximum ratings: modules operating outside of this range may get permanently damaged.

OPERATING CONDITIONS

# Recommended operating conditions

| PARAMETER | SYMBOL | MIN | TYPICAL | MAX | UNIT |
|---|---|---|---|---|---|
| Operating case temperature | $T_C$ | **0** | **/** | **70** | °C |
| Power supply voltage | $V_{CC}$ | **3.135** | **3.3** | **3.465** | V |
| Baud rate, per channel | BR | **53.125 -100 ppm** | **53.125** | **53.125 +100 ppm** | GBd |

1. Recommended operating conditions: modules operating outside of this range do not have the performance guaranteed.

MONITORING

# DDM accuracy

| PARAMETER | ACCURACY | UNIT | CALIBRATION |
|---|---|---|---|
| Temperature | **±3** | °C | Internal |
| Voltage | **±0.1** | V | Internal |
| Tx bias current, each lane | **±10** | % | Internal |
| Tx output power, each lane | **±3** | dB | Internal |
| Rx receive power, each lane | **±3** | dB | Internal |

MANAGEMENT

# Memory map

Refer to OIF-CMIS - common management interface specification (CMIS).

OPTICAL

# Optical characteristics

The following optical characteristics are defined over the recommended operating conditions unless otherwise specified.

| PARAMETER | SYMBOL | MIN | TYPICAL | MAX | UNIT | NOTES |
|---|---|---|---|---|---|---|
| **Transmitter (each lane)** | | | | | | |
| Signaling speed per lane | | **53.125 -100 ppm** | **53.125** | **53.125 +100 ppm** | GBd | |
| Modulation format | | | **PAM4** | | | |
| Center wavelength | | **1304.5** | **1311** | **1317.5** | nm | |
| Side-mode suppression ratio | SMSR | **30** | | | dB | |
| Average launch power per lane | $P_{AVG}$ | **-2.9** | | **4** | dBm | 1 |
| Outer optical modulation amplitude per lane | $OMA_{outer}$ | **-0.8** | | **4.2** | dBm | |
| Launch power in $OMA_{outer}$ minus TDECQ, each lane | | **-2.2** | | | dBm | |
| Extinction ratio | ER | **3.5** | | | dB | |
| Transmitter and dispersion penalty eye closure for PAM4 | TDECQ | | | **3.4** | dB | |
| Transmitter transition time | $T_r$, $T_f$ | | | **17** | ps | |
| $RIN_{14}OMA$ | | | | **-136** | dB/Hz | |
| Optical return loss tolerance | ORL | | | **21.4** | dB | |
| Average launch power of OFF transmitter | | | | **-15** | dBm | |

| PARAMETER | SYMBOL | MIN | TYPICAL | MAX | UNIT | NOTES |
|---|---|---|---|---|---|---|
| **Receiver (each lane)** | | | | | | |
| Signaling speed per lane | | **53.125 -100 ppm** | **53.125** | **53.125 +100 ppm** | GBd | |
| Modulation format | | | **PAM4** | | | |
| Center wavelength | | **1304.5** | **1311** | **1317.5** | nm | |
| Damage threshold | DT | **5** | | | dBm | |
| Average receive power per lane | $RXP_x$ | **-5.9** | | **4** | dBm | |
| Receive power, each lane ($OMA_{outer}$) | $OMA_{outer}$ | | | **4.2** | dBm | |
| Receiver reflectance | | | | **-26** | dB | |
| Receiver sensitivity ($OMA_{outer}$), each lane | | | | **-3.9** | dBm | 2 |
| Stressed receiver sensitivity ($OMA_{outer}$) | SRS | | | **-1.9** | dBm | |
| **Conditions of the stressed receiver sensitivity test** | | | | | | |
| Stressed eye closure for PAM4 (SECQ), lane under test | | | **3.4** | | dB | |
| $OMA_{outer}$ of each aggressor lane | | | **4.2** | | dBm | |

1. Optical output power, each lane (min), is informative and not the principal indicator of signal strength.
2. Measured with conformance test signal at TP3 with BER = 2.4E-4.

ELECTRICAL

# Electrical characteristics

The following electrical characteristics are defined over the recommended operating conditions unless otherwise specified.

| PARAMETER | SYMBOL | MIN | TYPICAL | MAX | UNIT | NOTES |
|---|---|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | **3.135** | | **3.465** | V | |
| Power consumption | | | | **9** | W | |
| **Module input** | | | | | | |
| Differential peak-to-peak voltage tolerance | | **750** | | | mV | TP1a |
| Peak-to-peak AC common-mode voltage tolerance, low-frequency | $V_{CMLF}$ | **32** | | | mV | TP1a |
| Peak-to-peak AC common-mode voltage tolerance, full-band | $V_{CMFB}$ | **80** | | | mV | TP1a |
| Differential-mode to common-mode return loss | $RL_{cd}$ | See IEEE 802.3ck™, 120G.3.3.3 | | | dB | TP1 |
| Effective return loss | ERL | **8.5** | | | dB | TP1 |
| Differential termination mismatch | | | | **10** | % | TP1 |
| Module stressed input tolerance | | See IEEE 802.3ck™, 120G.3.4.3 | | | | TP1a |
| Single-ended voltage tolerance | | **-0.4** | | **3.3** | V | TP1a |
| DC common-mode voltage tolerance | | **-0.35** | | **2.85** | V | TP1 |
| **Module output** | | | | | | |
| Differential peak-to-peak output voltage, short mode | | | | **600** | mV | TP4 |
| Differential peak-to-peak output voltage, long mode | | | | **845** | mV | TP4 |
| Peak-to-peak AC common-mode voltage, low-frequency | $V_{CMLF}$ | | | **32** | mV | TP4 |
| Peak-to-peak AC common-mode voltage, full-band | $V_{CMFB}$ | | | **80** | mV | TP4 |
| Eye height | | **15** | | | mV | TP4 |
| Vertical eye closure | VEC | | | **12** | dB | TP4 |
| Common-mode to differential-mode return loss | $RL_{dc}$ | See IEEE 802.3ck™, 120G.3.1.1 | | | dB | TP4 |
| Effective return loss | ERL | **8.5** | | | dB | TP4 |
| Differential termination mismatch | | | | **10** | % | TP4 |
| Transition time | | **8.5** | | | ps | TP4 |
| Common-mode voltage | $V_{cm}$ | **-0.35** | | **2.85** | V | TP4 |

| PARAMETER | SYMBOL | MIN | TYPICAL | MAX | UNIT | NOTES |
|---|---|---|---|---|---|---|
| **Low-speed signals - SCL and SDA ($I_{OLmax}$ = 3 mA)** | | | | | | |
| Output low voltage | $V_{OL}$ | **0** | | **0.4** | V | |
| Output high voltage | $V_{OH}$ | **$V_{CC}$ - 0.5** | | **$V_{CC}$ + 0.3** | V | |
| Input low voltage | $V_{IL}$ | **-0.3** | | **$V_{CC}$ × 0.3** | V | |
| Input high voltage | $V_{IH}$ | **$V_{CC}$ × 0.7** | | **$V_{CC}$ + 0.5** | V | |

HOST INTERFACE

# Pin assignment

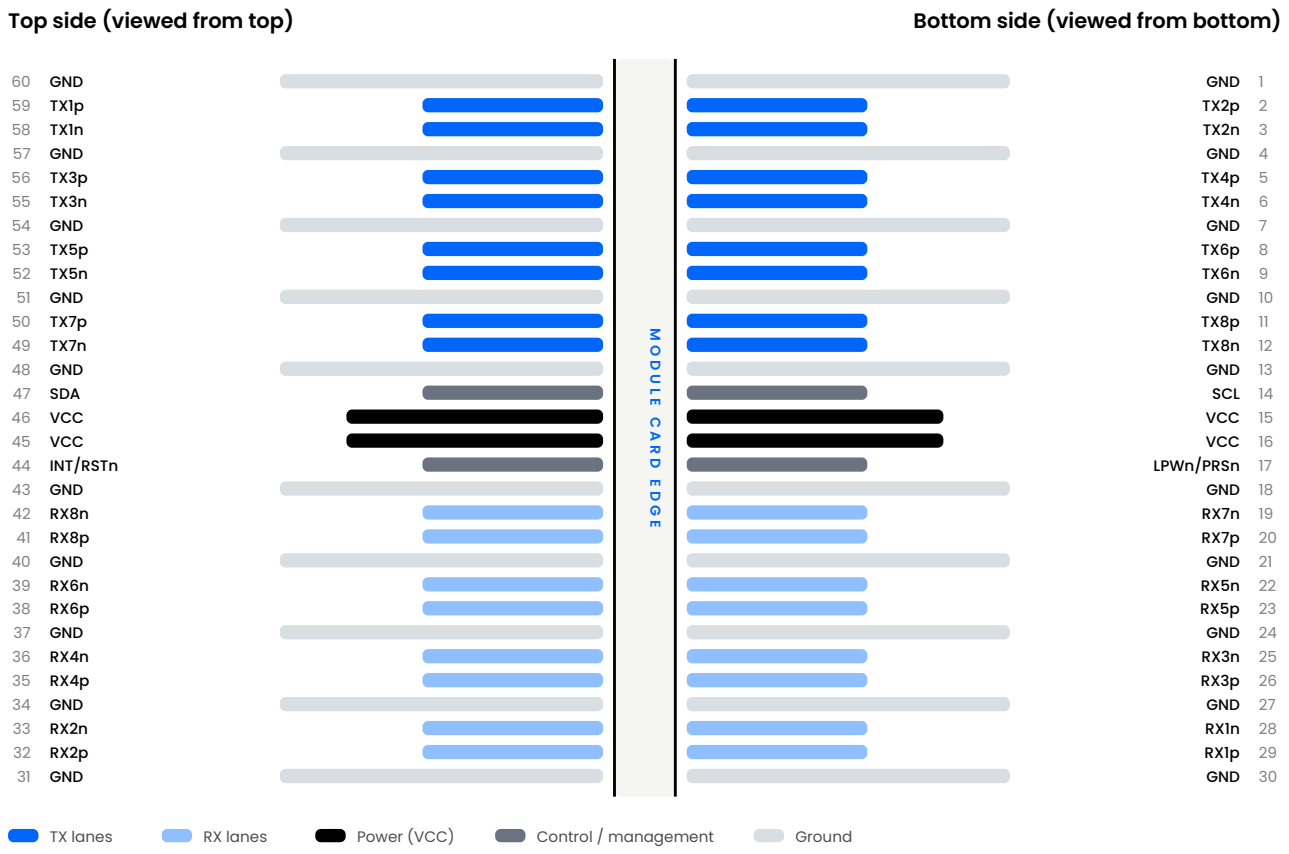



Figure 1. OSFP112 module pinout

SIGNALS

# Pin description

| NAME | DIRECTION | DESCRIPTION |
|---|---|---|
| **TX[8:1]p / TX[8:1]n** | Input | Transmit differential pairs from host to module. |
| **RX[8:1]p / RX[8:1]n** | Output | Receive differential pairs from module to host. |
| **SCL** | Bidirectional | 2-wire serial clock signal. Requires pull-up resistor to 3.3 V on host. |
| **SDA** | Bidirectional | 2-wire serial data signal. Requires pull-up resistor to 3.3 V on host. |
| **LPWn/PRSn** | Bidirectional | Multi-level signal for low power control from host to module and module presence indication from module to host. |
| **INT/RSTn** | Bidirectional | Multi-level signal for interrupt request from module to host and reset control from host to module. |
| **VCC** | Power | 3.3 V power for module. |
| **GND** | Ground | Module ground. Logic and power return path. |

ARCHITECTURE

# Principle diagram

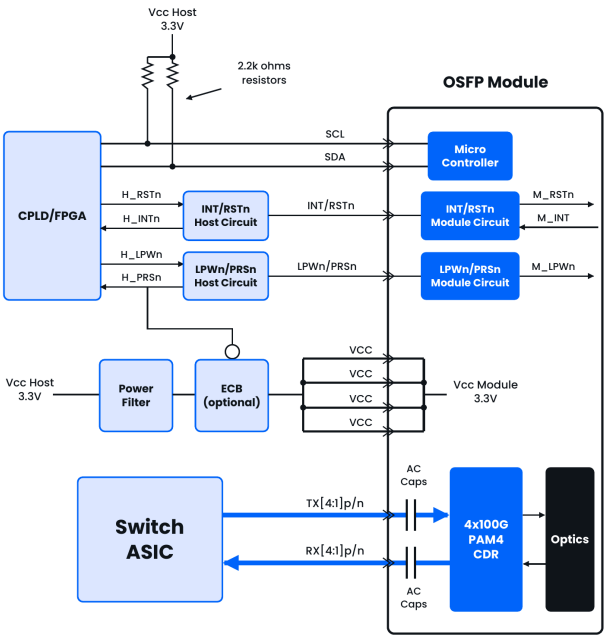



Figure 2. Module principle diagram

COMPLIANCE

# Regulatory and compliance

| CATEGORY | STANDARD |
|---|---|
| **EMC - immunity** | EN 55035:2017+A11:2020<br>IEC 61000-4-3:2020 |
| **EMC - emission** | FCC 47 CFR Part 15, Class B<br>EN 55032:2015+A11:2020+A1:2020 |
| **ESD threshold** | IEC EN 61000-4-2:2008 |
| **Product safety** | CB: IEC 62368-1:2018<br>TÜV Mark: EN IEC 62368-1:2020+A11<br>UL Recognized Component: UL 62368-1:2019 R10.21, CSA C22.2 No. 62368-1:19 |
| **Optical safety** | Class 1 laser product<br>FDA/CDRH<br>IEC 60825-1:2014<br>IEC 60825-2:2021<br>EN 60825-1:2014+A11 |
| **RoHS** | Complies with RoHS II Directive 2011/65/EU |

MECHANICAL

# Mechanical package outline

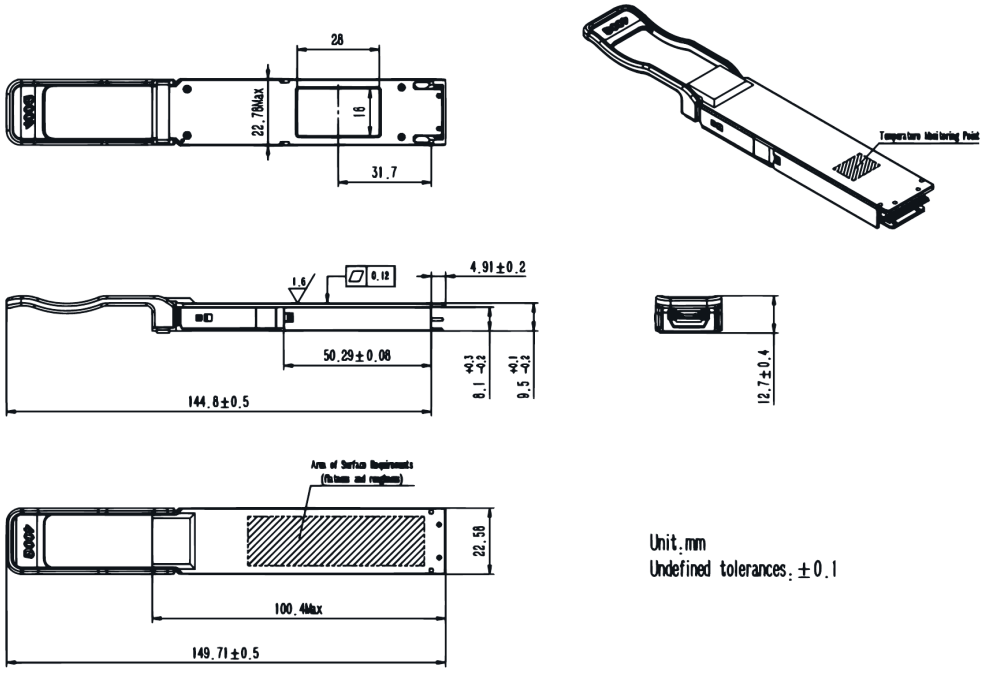



Figure 3. Mechanical package outline (all dimensions are in mm) · Unit: mm. Undefined tolerances: ±0.1.

# Optical interface

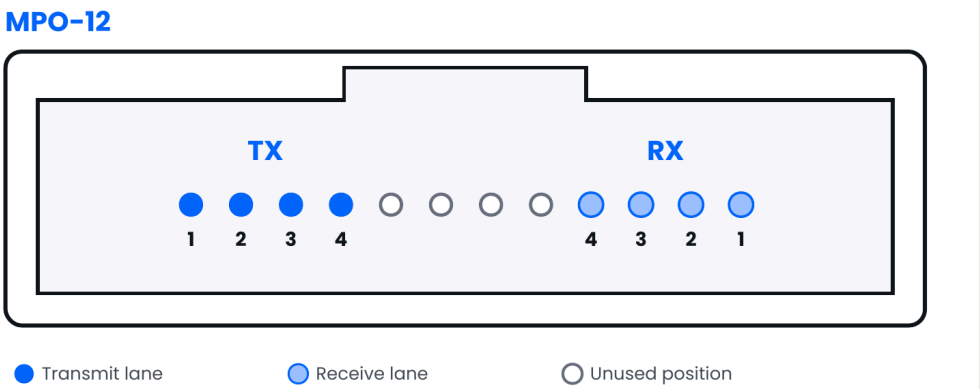



Figure 4. Optical receptacle.
Note: optical interface is 8° APC MPO-12. Lane sequence is shown in Figure 4.