DRIVENETS

DATASHEET

OPTICAL TRANSCEIVER · QSFP112

DriveNets 400G DR4

QSFP112 transceiver with an MPO-12 interface, 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 max



OVERVIEW

The DriveNets 400G QSFP112 DR4 is a hot-pluggable optical transceiver that transmits and receives serial optical data at 106.25 Gbps per channel using PAM4 modulation over single-mode fiber. Four 53.125 GBd electrical lanes map one-to-one onto four optical lanes 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 integrates a high-performance silicon-photonics modulator and a PAM4 DSP in a QSFP112 form factor, and is compliant with IEEE 802.3df, IEEE P802.3ck D3.0, the QSFP-112 MSA V2.0, OIF-CEI-112G-VSR-PAM4 and OIF-CMIS 5.2 management. Maximum power consumption is 9 W across a 0 °C to +70 °C case-temperature range, suiting high-density 400GbE switch and router line cards, AI cluster fabrics and datacenter 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

38-contact edge connector · 4 × 53.125 GBd host lanes

2-wire serial (SCL / SDA) · OIF-CMIS 5.2 memory map

IEEE P802.3ck D3.0 · OIF-CEI-112G-VSR-PAM4

Power & environmental

9 W maximum power consumption · 3.3 V supply

0 °C to +70 °C case · QSFP112 form factor

RoHS II 2011/65/EU · digital diagnostics monitoring

HARDWARE SPECIFICATION

Key specifications

Ordering & package

Part number	**DNOT00007**
Form factor	**QSFP112**
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 lane	**53.125 GBd ±100 ppm**
Power consumption	**9 W maximum**
Input differential swing (TP1a)	**900 mVpp min**
Output differential swing (TP4)	**860 mVpp max**
Output common-mode noise (RMS)	**17.5 mV max**

Optical – transmitter

Modulation format	**PAM4**
Lane wavelength	**1304.5 – 1317.5 nm**
Output power (PAVG)	**-2.9 to 4 dBm**
OMAouter minus TDECQ	**-2.2 dBm min**
TDECQ, max	**3.4 dB**
Side-mode suppression	**30 dB min**
Extinction ratio	**3.5 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**

Optical – receiver

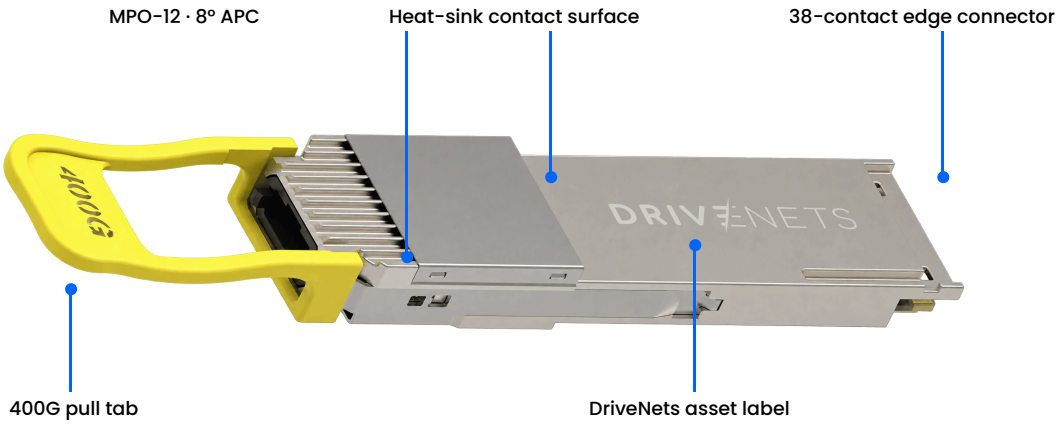
Average receive power	**-5.9 to 4 dBm**
Sensitivity (OMAouter)	**-3.9 dBm @ 1E-6**
Stressed sensitivity	**-1.9 dBm**
Receive power (OMAouter)	**4.2 dBm max**
Damage threshold	**5 dBm per lane**

Management & DDM

Host interface	**38-contact edge connector**
Memory map	**OIF-CMIS 5.2**
Temperature / voltage	**±3 °C / ±0.1 V**
Tx bias current, per lane	**±10%**
Tx / Rx power, per lane	**±3 dB**

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

ESD: 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
- Switch & router connections
- Datacenters & AI clusters
- Other 400G interconnect

Reference documents

- IEEE 802.3df
- IEEE P802.3ck™/D3.0
- CMIS rev 5.2
- QSFP-112 MSA V2.0
- OIF-CEI-112G-VSR-PAM4

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
Rx damage threshold, per lane			**5**	dBm

1. 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. 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 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	MF		**PAM4**			
Lane wavelength (range)	λ	**1304.5**	**1311**	**1317.5**	nm	
Side-mode suppression ratio	SMSR	**30**			dB	
Optical output power	P_{AVG}	**-2.9**		**4**	dBm	1
Outer optical modulation amplitude	OMA_{outer}	**-0.8**		**4.2**	dBm	
Transmitter and dispersion eye closure for PAM4	TDECQ			**3.4**	dB	
Launch power in OMA_{outer} minus TDECQ		**-2.2**			dBm	
Extinction ratio, each lane	ER	**3.5**			dB	
Transmitter transition time				**17**	ps	
Average launch power of OFF transmitter				**-15**	dBm	
$RIN_{21.4}OMA$				**-136**	dB/Hz	
Optical return loss tolerance				**21.4**	dB	
Transmitter reflectance				**-26**	dB	2

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	MF		**PAM4**			
Lane wavelength (range)	λ	**1304.5**	**1311**	**1317.5**	nm	
Damage threshold, each lane		**5**			dBm	
Average receive power, each lane		**-5.9**		**4**	dBm	
Receive power (OMA_{outer}), each lane				**4.2**	dBm	
Receiver sensitivity (OMA_{outer})	RS			**-3.9**	dBm	BER@1E-6
Receiver reflectance	RR			**-26**	dB	
Stressed receiver sensitivity (OMA_{outer})	SRS			**-1.9**	dBm	
Conditions of 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. Transmitter reflectance is defined looking into the transmitter.

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	PC			**9**	W	
Module input						
Differential data output swing	V_{pp}	**900**			mV	TP1a
Differential termination mismatch				**10**	%	TP1
DC common-mode voltage tolerance	V_{cm}	**-0.35**		**2.85**	V	TP1
Module output						
Differential data output swing	V_{pp}			**860**	mV	TP4
Common mode noise (RMS)				**17.5**	mV	TP4
Differential termination mismatch				**10**	%	TP4
DC common-mode voltage tolerance	V_{cm}	**-0.35**		**2.85**	V	TP4
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	

Pin assignment



Figure 1. QSFP112 module pinout

SIGNALS

Pin description

NAME	PIN	DIRECTION	DESCRIPTION
TX[4:1]p / TX[4:1]n		Input	Transmit differential pairs from host to module.
RX[4:1]p / RX[4:1]n		Output	Receive differential pairs from module to host.
ModSelL	8		Module select
ResetL	9		Module reset
SCL	11	Bidirectional	2-wire serial clock signal.
SDA	12	Bidirectional	2-wire serial data signal.
ModPrsL	27		Module Present
IntL / RxLOS	28		Multi-level signal for interrupt request from module to host and receive signal loss alarm.
LPmode / TxDis	31		Multi-level signal for low power mode and transmission channel disable.
VCC	10, 29, 30	Power	3.3 V power for module.
GND		Ground	Module ground. Logic and power return path.

ARCHITECTURE

Functional block diagram

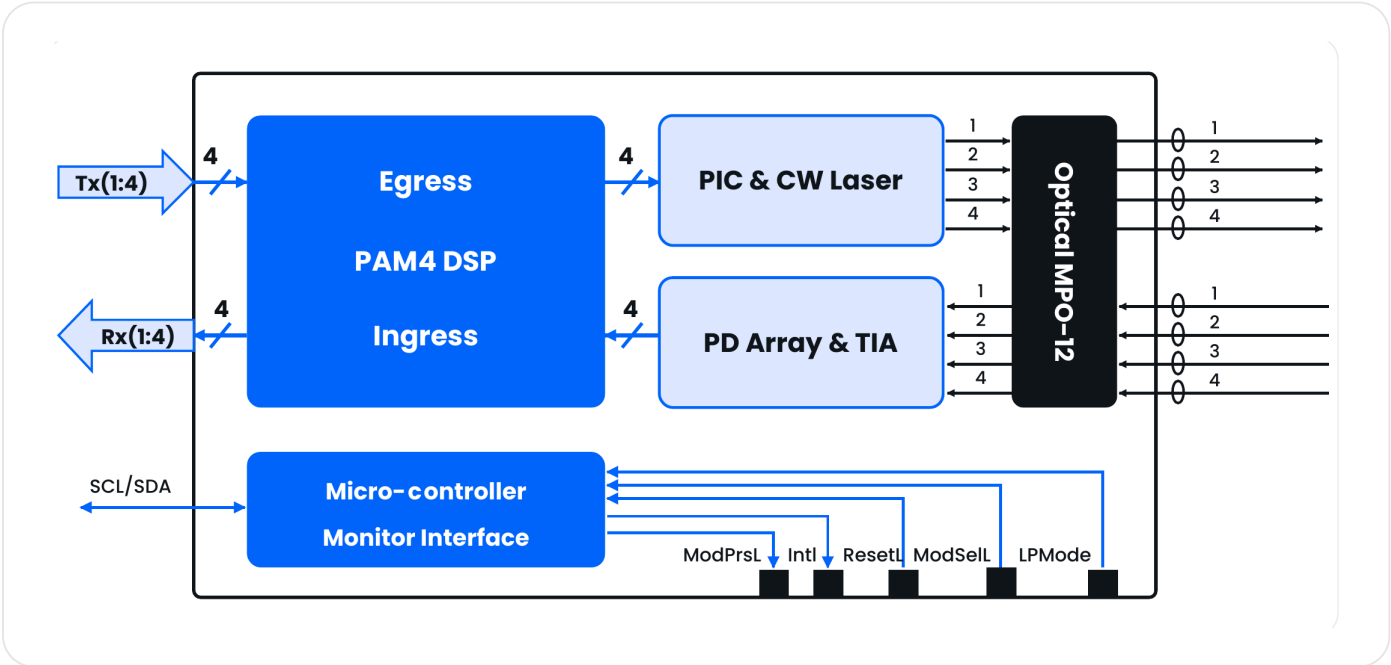


Figure 2. 400G QSFP112 DR4 functional block diagram

COMPLIANCE

Regulatory and compliance

CATEGORY	STANDARD
EMC - immunity	EN 55035:2017+A11:2020 IEC 61000-4-3:2020
EMC - emission	FCC 47 CFR Part 15, Class B EN 55032:2015+A11:2020+A1:2020
ESD threshold	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 safety	Class 1 laser product FDA/CDRH IEC 60825-1:2014 IEC 60825-2:2021 EN 60825-1:2014+A11
RoHS	Complies with RoHS II Directive 2011/65/EU

MECHANICAL

Mechanical package outline

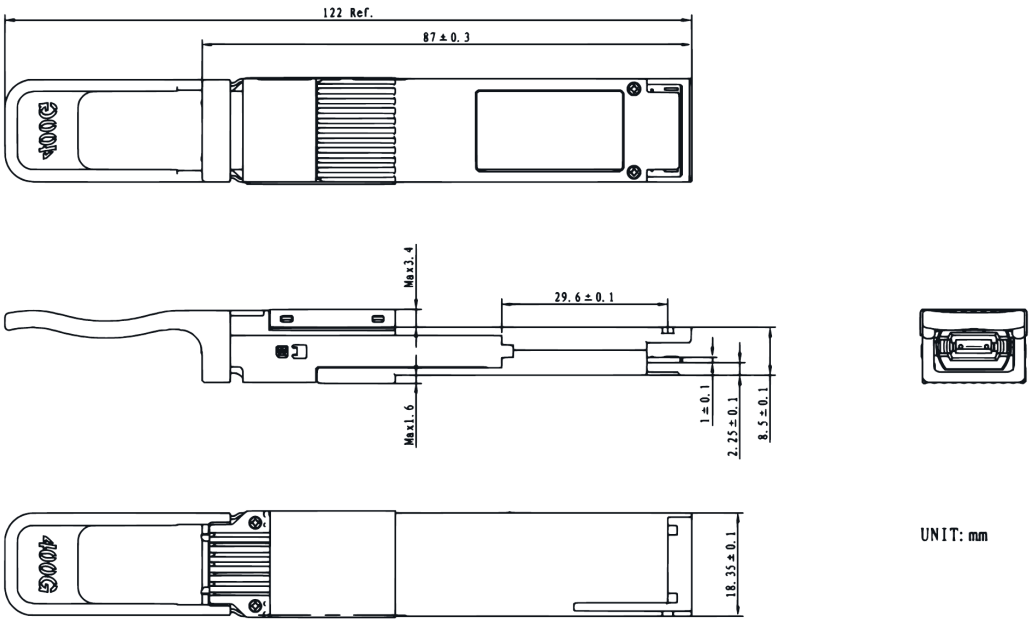


Figure 3. Mechanical package outline (all dimensions are in mm)

Optical interface

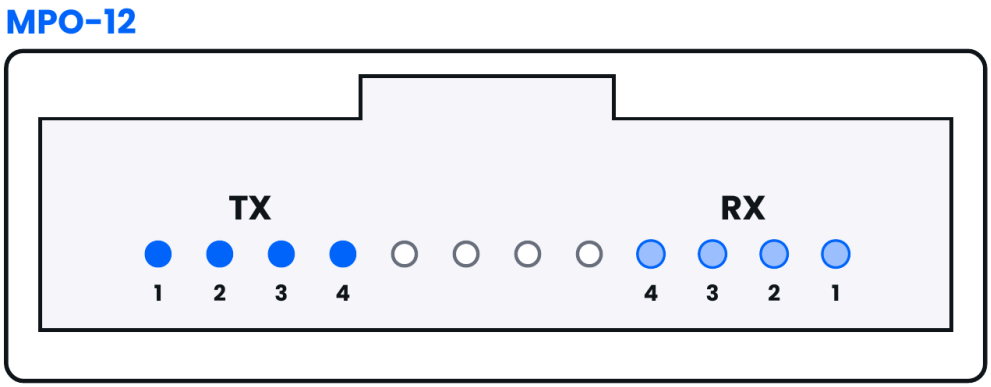


Figure 4. Optical lane sequence.
Note: optical interface is 8° APC MPO-12.