DRIVENETS

DATASHEET

OPTICAL TRANSCEIVER · QSFP28

DriveNets 100G DR1

QSFP28 transceiver with a duplex LC interface and a cooled EML laser, delivering 100G PAM4 over single-mode fiber for 100GbE switch, router and AI cluster interconnect.

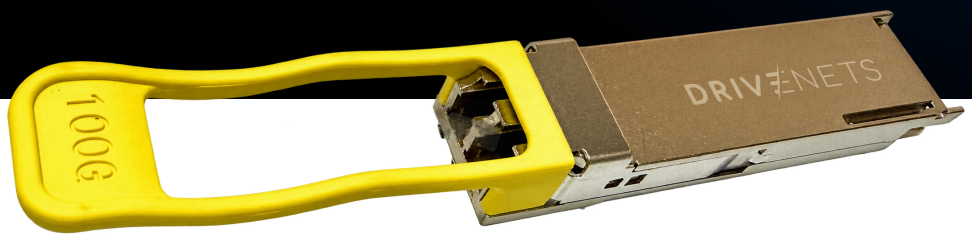
100 Gbps

DATA RATE

106.25G PAM4

Duplex LC · 500 m

4.5 W maximum



OVERVIEW

The DriveNets 100G QSFP28 DR1 is a small-form-factor, hot-pluggable optical transceiver designed to transmit and receive serial optical data at up to 106.25 Gbps using PAM4 modulation over single-mode fiber. Four 25G host electrical lanes feed a 100G PAM4 DSP that drives a single optical lane at 53.125 GBd, presented on a duplex LC interface for reaches up to 500 m. The module integrates a high-performance cooled EML laser in a QSFP28 form factor and is compliant with 100G Ethernet specifications - IEEE Std 802.3cu-2022 - the QSFP28 MSA, CEI-28G-VSR and SFF-8636 management. Maximum power consumption is 4.5 W across a 0 °C to +70 °C case-temperature range, for 100GBASE-DR1 Ethernet, switch and router connections, datacenters and AI clusters.

Optical interface

Duplex LC · 1 lane at 106.25 Gbps PAM4

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

Cooled EML laser · Class 1 laser product

Electrical & management

38-pin connector · 4 × 25G host lanes

2-wire serial (SCL / SDA) · SFF-8636 R2.10a memory map

CEI-28G-VSR · QSFP28 MSA · IEEE 802.3cu-2022

Power & environmental

4.5 W maximum power consumption

0 °C to +70 °C case temperature

RoHS II 2011/65/EU · digital diagnostics monitoring

HARDWARE SPECIFICATION

Key specifications

Ordering & package

Part number	**DNOT00024**
Form factor	**QSFP28**
Optical interface	**Duplex LC**
Data rate	**100G (53.125 GBd PAM4)**
Reach	**500 m single-mode fiber**

Electrical

Supply voltage (VCC)	**3.135 – 3.465 V**
Baud rate	**53.125 GBd ±100 ppm**
Power consumption	**4.5 W maximum**
Input differential voltage (TP1a)	**900 mV max**
Output differential voltage (TP4)	**900 mV max**
Output eye height / VEC (TP4)	**228 mV min / 5.5 dB max**

Optical – transmitter

Modulation format	**PAM4**
Center wavelength	**1304.5 – 1317.5 nm**
Average launch power (PAVG)	**-2.9 to 4 dBm**
OMAouter, max(TECQ, TDECQ) ≤ 1.4 dB	**-0.8 to 4.2 dBm**
TDECQ, max	**3.4 dB**
Side-mode suppression (SMSR)	**30 dB**
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), TECQ ≤ 1.4 dB	**-3.9 dBm**
Stressed sensitivity	**-1.9 dBm**
Damage threshold	**5 dBm**
Receiver reflectance	**-26 dB max**

Management

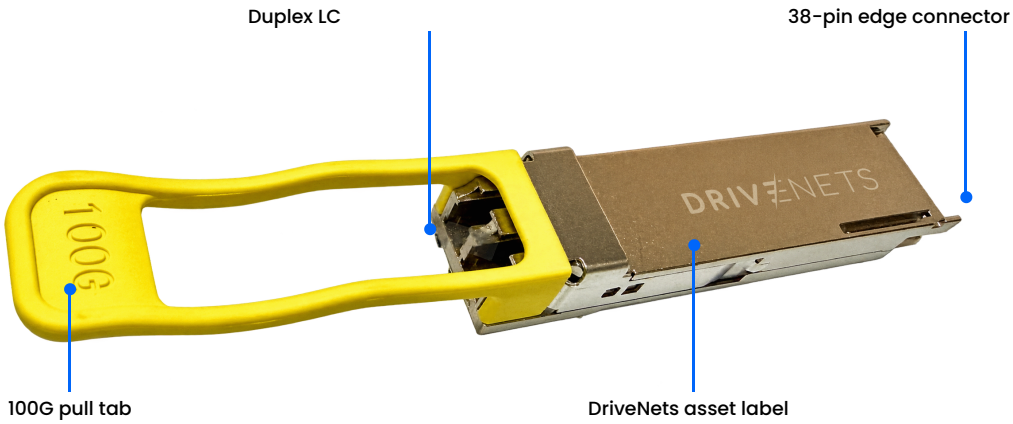
Host interface	**38-pin connector**
Control	**2-wire serial (SCL / SDA)**
Memory map	**SFF-8636 R2.10a**

DDM accuracy

Temperature	**±3 °C**
Supply voltage	**±0.1 V**
Tx bias current, per lane	**±10%**
Tx output power, per lane	**±3 dB**
Rx receive 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

100 Gbps
DATA RATE

1 × 106G
PAM4 OPTICAL LANE

500 m
REACH OVER SMF

4.5 W
MAXIMUM POWER

APPLICATIONS & STANDARDS

Applications

- 100GBASE-DR1 Ethernet
- Switch & router connections
- Datacenters & AI clusters
- Other 100G interconnect

Reference documents

- CEI-28G-VSR
- QSFP28 MSA
- IEEE Std 802.3cu™-2022
- SFF-8636

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 SFF-8636 R2.10a.

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	MF		**PAM4**			
Center wavelength	CW	**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 OMA, max(TECQ, TDECQ) ≤ 1.4 dB	OMA_{outer}	**-0.8**		**4.2**	dBm	
Outer OMA, 1.4 < max(TECQ, TDECQ) ≤ 3.4 dB	OMA_{outer}	**-0.8**		**4.2**	dBm	
Transmitter excursion, each lane	-			**-**	dB	
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			**15.5**	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	MF		**PAM4**			
Center wavelength	CW	**1304.5**	**-**	**1317.5**	nm	
Damage threshold	DT	**5**			dBm	
Average receive power per lane	-	**-5.9**		**4**	dBm	
Receive power, each lane (OMA_{outer})	-			**4.2**	dBm	
Receiver reflectance	-			**-26**	dB	
Receiver sensitivity (OMA_{outer}), TECQ ≤ 1.4 dB	-			**-3.9**	dBm	
Receiver sensitivity (OMA_{outer}), 1.4 < TECQ ≤ 3.4 dB	-			**-5.3 + TECQ**	dBm	
Stressed receiver sensitivity (OMA_{outer})	SRS			**-1.9**	dBm	
Conditions of the stressed receiver sensitivity test						
Stressed eye closure for PAM4 (SECQ)	-		**3.4**		dB	
SECQ - $10\log_{10}$(Ceq) (max)	-		**3.4**		dB	

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	PC			**4.5**	W	
Module input						
Differential termination mismatch at 1 MHz	%			**10**	%	TP1
Differential voltage	mV_{PP}			**900**	mV	TP1a
Common mode noise	mV_{rms}			**17.5**	mV	TP1a
Rise and fall time (20% to 80%)	ps	**10**			ps	TP1a
Eye height	mV	**100**			mV	TP1a
Eye width	UI	**0.46**			UI	TP1a
Module output						
Differential peak-to-peak output voltage	-			**900**	mV	TP4
Eye height	EH	**228**			mV	TP4
Eye width	EW	**0.57**			UI	TP4
Vertical eye closure	VEC			**5.5**	dB	TP4
Rise and fall time (20% to 80%)	ps	**9.5**			ps	TP4
Common mode noise	mV_{rms}			**17.5**	mV	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	

HOST INTERFACE

Pin assignment



Figure 1. QSFP28 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 los 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

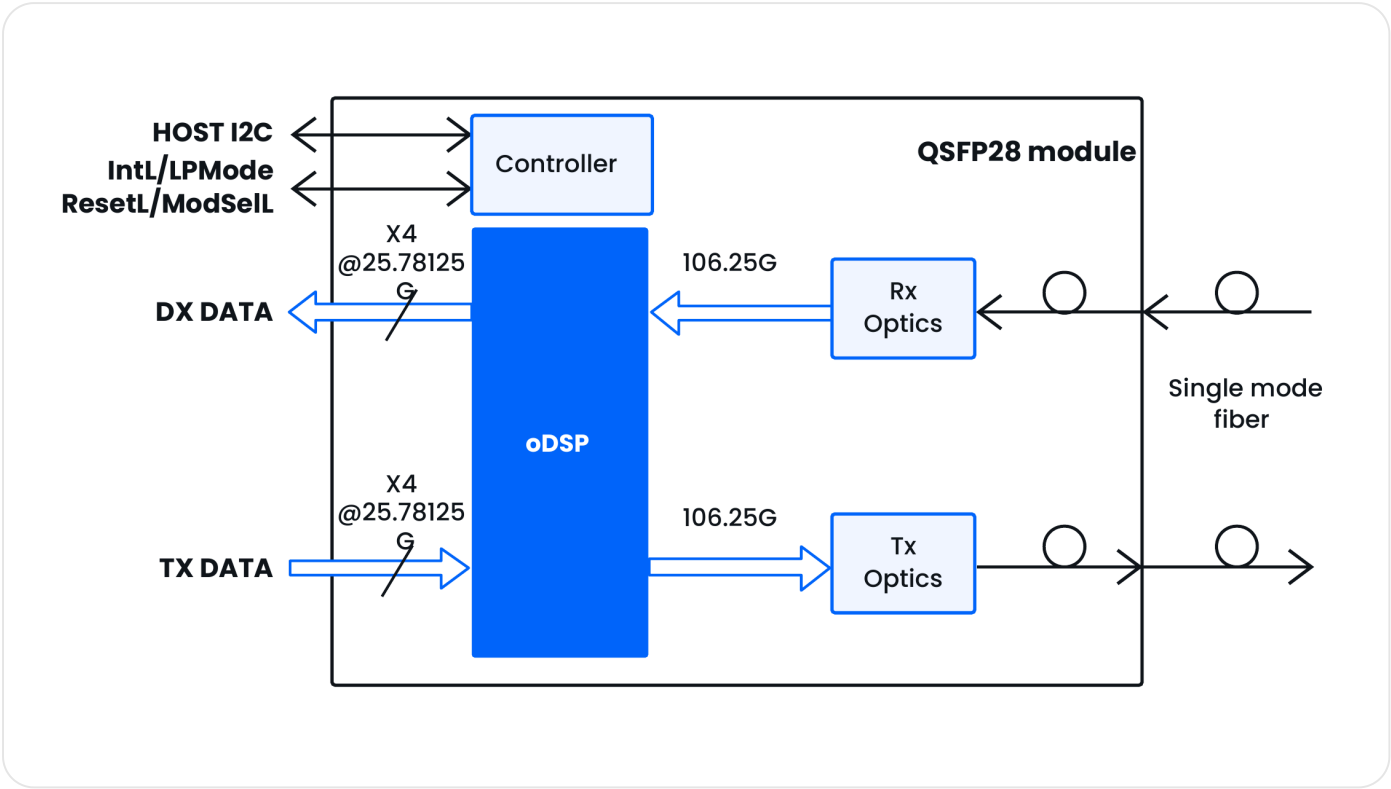


Figure 2. 100G QSFP28 DR1 functional block diagram

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

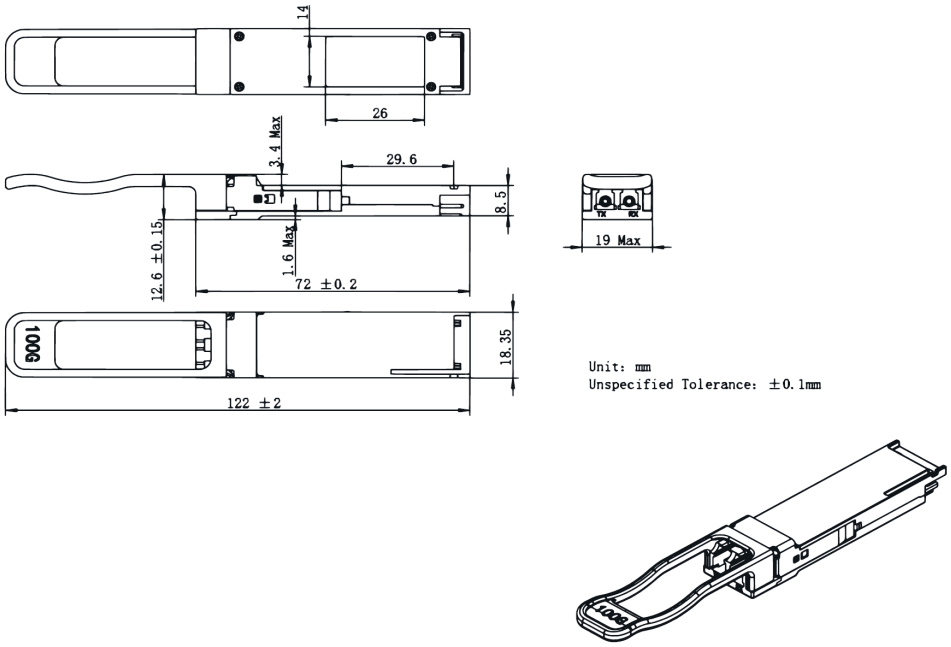


Figure 3. Mechanical package outline (all dimensions are in mm) · Unit: mm. Unspecified tolerance: ±0.1 mm.

FIBER INTERFACE

Optical interface

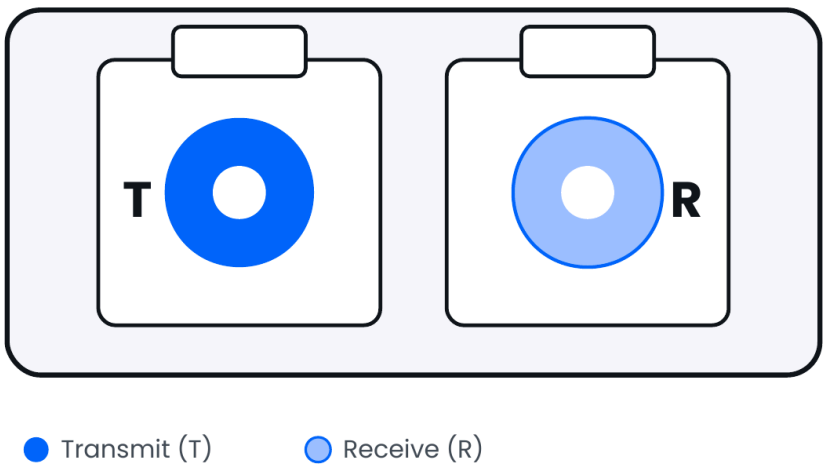


Figure 4. Optical receptacle.
Note: optical interface is duplex LC.