DRIVENETS

DATASHEET

OPTICAL TRANSCEIVER · SFP+

DriveNets 10G SFP+ LR

SFP+ 1310 nm DFB transceiver with a duplex LC interface, carrying 8.5 to 10.52 Gbps over 10 km of single-mode fiber.

10 Gbps

DATA RATE

8.5 - 10.52 Gb/s

Duplex LC · 10 km

1 W maximum



OVERVIEW

The DriveNets 10G SFP+ LR is a 10 Gigabit 1310 nm DFB transceiver designed to transmit and receive serial optical data links from 8.5 Gbps to 10.52 Gbps over 10 km of single-mode fiber. The transmit path drives a TOSA from a laser driver, and the receive path combines a ROSA and TIA with a post amplifier, all supervised by an MCU with controller and flash memory. The transceiver is compliant with SFF-8432, 10GFC, FC-PI-4, IEEE 802.3ae and applicable portions of SFF-8431, and digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472. The module presents a duplex LC receptacle compliant with IEC 61754-20, with a maximum power consumption of 1 W across a 0 °C to +70 °C case-temperature range, for 10GBASE-LR/LW, 10G Ethernet, 10GFC and 8GFC applications.

Optical interface

Duplex LC receptacle per IEC 61754-20

1310 nm DFB · 10 km over single-mode fiber

Output power -8.2 to +0.5 dBm

Electrical & management

20-contact SFP+ host interface · 3.3 V supply

2-wire serial interface · SFF-8472 digital diagnostics

CML data · LVTTL transmitter disable

Power & environmental

1 W maximum · 315 mA maximum supply current

0 °C to +70 °C case temperature

Compliant with EU RoHS Directive 2011/65/EU

HARDWARE SPECIFICATION

Key specifications

Ordering & package

Part number	**DNOT00023**
Form factor	**SFP+**
Optical interface	**Duplex LC**
Data rate	**8.5 - 10.52 Gb/s (10.3125 typ.)**
Reach	**10 km single-mode fiber**

Optical - transmitter

Nominal wavelength	**1260 - 1355 nm (1310 typ.)**
Side-mode suppression	**30 dB min**
Optical modulation amplitude	**-5.2 dBm min**
Optical output power	**-8.2 to 0.5 dBm**
Extinction ratio	**3.5 dB min**
Transmitter and dispersion penalty	**3.2 dB max**

Optical - receiver

Center wavelength	**1260 - 1355 nm**
Average receiver power	**-14.4 to +0.5 dBm**
Receiver sensitivity (OMA)	**-12.6 dBm max**
Stressed sensitivity (OMA)	**-10.3 dBm max**
Assert / de-assert LOS	**-30 dBm min / -16 dBm max**

Electrical

Supply voltage (VCC)	**3.135 - 3.465 V**
Supply current	**315 mA max**
Input differential impedance	**80 - 120 Ω**
Differential data input swing	**190 - 700 mVp-p**
Differential data output swing	**300 - 850 mVp-p**

Environmental

Operating case temp	**0 °C - +70 °C**
Storage temperature	**-40 °C - +85 °C**
Relative humidity	**0% - 95%**
VCC absolute maximum	**-0.3 V - +4 V**

Management

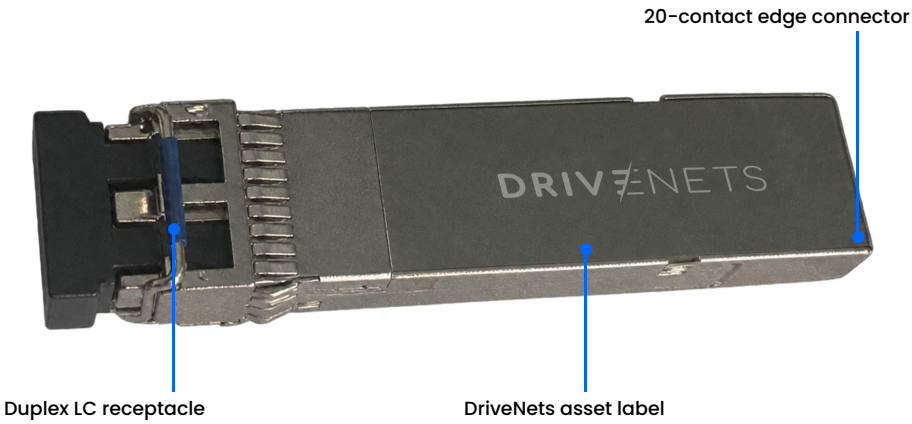
Host interface	**20-contact SFP+ connector**
Control	**2-wire serial (SDA / SCL)**
Memory map	**SFF-8472 Rev 10.4**

DDM accuracy

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

INTERFACE OVERVIEW

Module layout



REGULATORY COMPLIANCE

Certifications

EMC

EMI: CISPR22 ITE Class B

EN55022 Class B · FCC Class B

Immunity: IEC61000-4-3 Class 2 · EN55024

ESD immunity: variation of IEC 61000-4-2, LV 4

ESD & safety

ESD to electrical pins: MIL-STD-883C method 3015.7 Class 1 (> 1500 Volts)

Safety: FDA · UL · TUV · CE

RoHS

Compliant with EU RoHS directive 2011/65/EU

BS EN 1122: 2001

US EPA method 3050B · 3052

US EPA method 3060A

10 Gbps
DATA RATE

10 km
REACH OVER SMF

1310 nm
DFB LASER

1 W
MAXIMUM POWER

APPLICATIONS & STANDARDS

Applications

- 10GBASE-LR/LW
- 10G Ethernet
- 10GFC
- 8GFC

Reference documents

- SFF-8431 Rev 3.0
- SFF-8472 Rev 10.4
- IEEE 802.3ae
- 10GFC Rev 4.0
- SFF-8432 Rev 5.0
- FC-PI-4 Rev 8.0

RATINGS

Absolute maximum ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Storage temperature range	T_S	**-40**	**+85**	°C
Relative humidity	RH	**0**	**95**	%
Power supply voltage	V_{CC}	**-0.3**	**+4**	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	-	**8.5**	**10.3125**	**10.52**	Gbps

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	External
Voltage	**±0.1**	V	External
Tx bias current	**±10**	%	External
Tx output power	**±3**	dB	External
Rx receive power	**±3**	dB	External

MANAGEMENT

Memory map

Refer to SFF-8472 Rev 10.4.

OPTICAL

Optical characteristics

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

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Transmitter						
Nominal wavelength	λ	**1260**	**1310**	**1355**	nm	
Side mode suppression ratio	SMSR	**30**			dB	
Optical modulation amplitude	P_{OMA}	**-5.2**			dBm	
Optical output power	P_{av}	**-8.2**		**0.5**	dBm	
Extinction ratio	ER	**3.5**			dB	
Transmitter and dispersion penalty	TDP			**3.2**	dB	
Average launch power of OFF transmitter	P_{OFF}			**-30**	dBm	
Relative intensity noise	RIN			**-128**	dB/Hz	
Optical return loss tolerance	ORLT			**12**	dB	
Spectral width	-			**1**	nm	
Output optical eye		Complies with IEEE802.3ae eye masks with filter 0 hits with 5% margin (0.25, 0.40, 0.45, 0.25, 0.28, 0.40)				
Receiver						
Center wavelength	λ	**1260**		**1355**	nm	
Average receiver power	P_{AVG}	**-14.4**		**+0.5**	dBm	1
Receiver sensitivity (OMA)	R_{SENSE1}			**-12.6**	dBm	1
Stressed receiver sensitivity (OMA)	R_{SENSE2}			**-10.3**	dBm	2
Max input power	-			**1.5**	dBm	
Receiver reflectance	R_{REFL}			**-12**	dB	
Assert LOS	LOS_A	**-30**			dBm	
De-assert LOS	LOS_D			**-16**	dBm	
LOS hysteresis	-	**0.5**			dB	

1. Sensitivity for 10G PRBS 231-1 and BER better than or equal to 10E-12.
2. The stressed sensitivity value in the table are for system level BER measurements which include the effects of CDR circuit.

ELECTRICAL

Electrical characteristics

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

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Supply voltage	V_{CC}	**3.135**	**3.3**	**3.465**	V	
Supply current	I_{cc}			**315**	mA	
Transmitter						
Input differential impedance	R_{IN}	**80**	**100**	**120**	Ω	1
Differential data input swing	V_{IN}	**190**		**700**	mV_{p-p}	
Transmit disable voltage	V_{DIS}	**2**		**V_{CCHOST}**	V	
Transmit enable voltage	V_{EN}	**V_{EE}**		**V_{EE}+0.8**	V	
Transmit fault assert voltage	V_{FA}	**2.2**		**V_{CCHOST}**	V	
Transmit fault de-assert voltage	V_{FDA}	**V_{EE}**		**V_{EE}+0.4**	V	
Receiver						
Differential data output swing	V_{OD}	**300**		**850**	mV_{p-p}	
LOS fault	V_{LOSFT}	**2.2**		**V_{CCHOST}**	V	
LOS normal	V_{LOSNR}	**V_{EE}**		**V_{EE}+0.4**	V	

HOST INTERFACE

Pin assignment



SFP module pinout

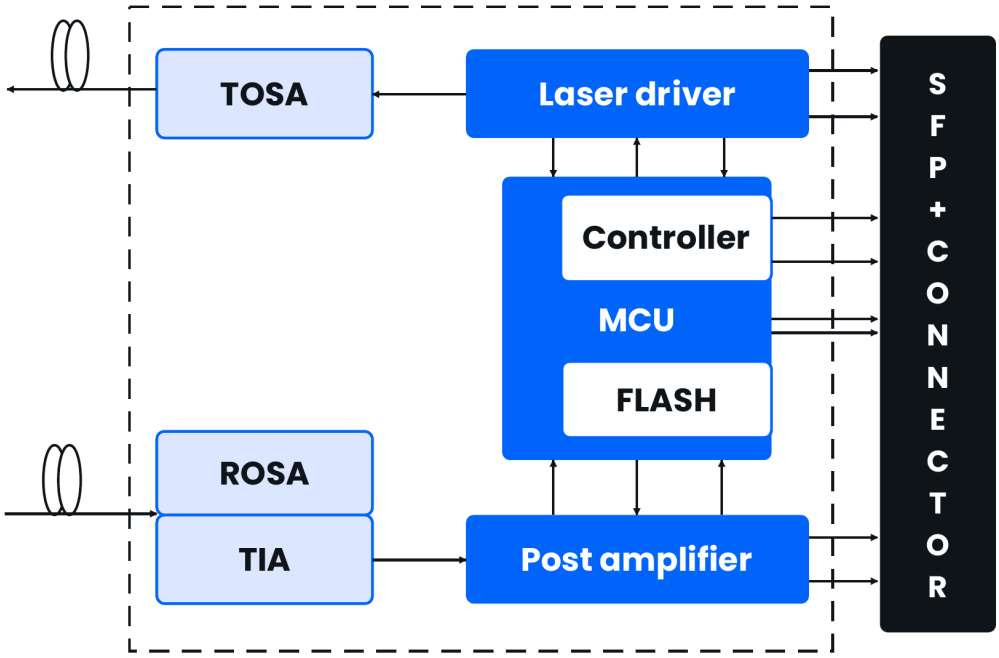
SIGNALS

Pin description

PIN NUMBER	SYMBOL	NAME	DESCRIPTION
1, 17, 20	**VeeT**	Transmitter Signal Ground	These pins should be connected to signal ground on the host board.
2	**TX Fault**	Transmitter Fault Out (OC)	Logic “1” output = laser fault (laser off before t_fault) Logic “0” output = normal operation This pin is open collector compatible, and should be pulled up to Host Vcc with a 10kΩ resistor.
3	**TX Disable**	Transmitter Disable In (LVTTL)	Logic “1” input (or no connection) = Llaser off Logic “0” input = laser on This pin is internally pulled up to VccT with a 10 kΩ resistor.
4 5 6	**SDA** **SCL** **MOD-ABS**	Module Definition Identifiers	Serial ID with SFF 8472 Diagnostics Module definition pins should be pulled up to Host Vcc with 10 kΩ resistors.
7 9	**RS0** **RS1**	Receiver Rate Select (LVTTL) Transmitter Rate Select (LVTTL)	These pins have an internal 33kΩ pull-down to ground. A signal on either of these pins will not affect module performance.
8	**LOS**	Loss of Signal Out (OC)	Sufficient optical signal for potential BER < $1x10^{-12}$ = Logic “0” Insufficient optical signal for potential BER < $1x10^{-12}$ = Logic “1” This pin is open collector compatible, and should be pulled up to Host Vcc with a 10kΩ resistor.
10, 11, 14	**VeeR**	Receiver Signal Ground	These pins should be connected to signal ground on the host board.
12	**RD-**	Receiver Negative DATA Out (CML)	Light on = logic “0” output receiver DATA output is internally AC coupled and series terminated with a 50Ω resistor.
13	**RD+**	Receiver Positive DATA Out (CML)	Light on = logic “1” output receiver DATA output is internally AC coupled and series terminated with a 50Ω resistor.
15	**VccR**	Receiver Power Supply	This pin should be connected to a filtered +3.3V power supply on the host board. Recommended power supply filter
16	**VccT**	Transmitter Power Supply	This pin should be connected to a filtered +3.3V power supply on the host board. Recommended power supply filter
18	**TD+**	Transmitter Positive DATA In (CML)	Logic “1” input = light on transmitter DATA inputs are internally AC coupled and terminated with a differential 100Ω resistor.
19	**TD-**	Transmitter Negative DATA In (CML)	Logic “0” input = light on transmitter DATA inputs are internally AC coupled and terminated with a differential 100Ω resistor.

ARCHITECTURE

Functional block diagram



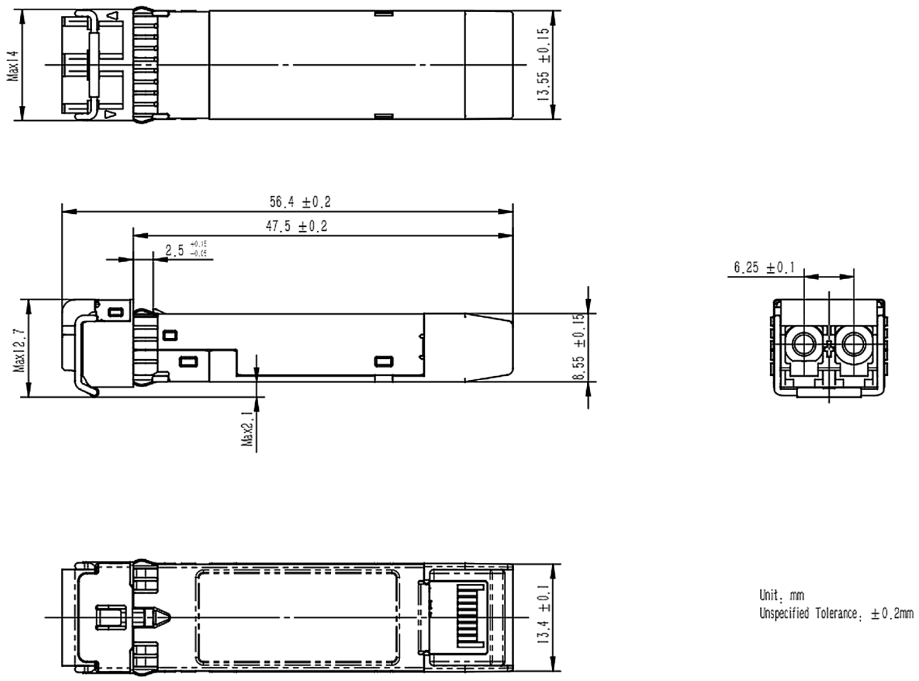
COMPLIANCE

Regulatory and compliance

FEATURE	TEST METHOD	PERFORMANCE
RoHS	BS EN 1122: 2001 US EPA METHOD 3050B US EPA METHOD 3052 US EPA METHOD 3060A	Compliant with EU RoHS Directive 2011/65/EU
Electrostatic discharge (ESD) to the electrical pins	MIL-STD-883C Method 3015.7	Class 1 (> 1500 Volts)
Electrostatic discharge (ESD) immunity	Variation of IEC 61000-4-2	LV 4 (Air discharge: 15KV; Contact discharge: 8 KV)
Electromagnetic interference (EMI)	CISPR22 ITE Class B EN55022 Class B FCC Class B	Compliant with standards
Immunity	IEC61000-4-3 Class 2 EN55024	Typically show no measurable effect from a 3V/m field swept from 80 to 1000MHz applied to the transceiver without a chassis enclosure.
Safety	FDA UL TUV CE	Compliant with standards

MECHANICAL

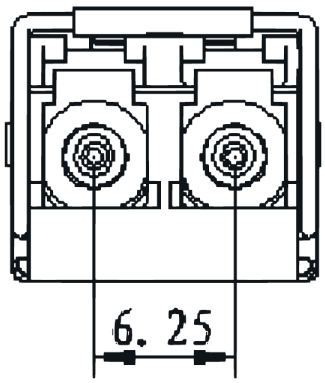
Mechanical package outline



Mechanical package outline · Unit: mm. Unspecified tolerance: ±0.2 mm.

FIBER INTERFACE

Optical interface



Optical receptacle.
The optical interface is a duplex LC receptacle compliant with IEC 61754-20.