DRIVENETS

DATASHEET

OPTICAL TRANSCEIVER · SFP

DriveNets 1G SFP LX

SFP transceiver with a duplex LC interface for Gigabit Ethernet and Gigabit Fiber Channel, carrying 1.25 / 1.0625 Gbps with a 10 km reach over single-mode fiber.

1.25 Gbps

DATA RATE

1.25 / 1.0625 Gbps

Duplex LC · 10 km SMF

1.0 W maximum



OVERVIEW

The DriveNets 1G SFP LX is a transceiver designed for Gigabit Ethernet applications. It is an integrated module containing an automatic optical output power control circuit, a laser driver and a laser diode, a PIN photo-detector that converts the optical signal to electrical current, a limiting amplifier, and an EEPROM that provides remote inventory over a serial interface, so the module performs both optical-to-electrical and electrical-to-optical conversion. It runs at 1.25 / 1.0625 Gbps over a duplex LC receptacle with a 10 km reach over single-mode fiber, launching in the 1270 - 1355 nm range, and is compliant with the SFP MSA (INF-8074i), SFF-8472 v12.4, IEEE 802.3z Gigabit Ethernet and FC-PI v2.0. Maximum power consumption is 1.0 W across a 0 °C to +70 °C case-temperature range, for Gigabit Ethernet, Gigabit Fiber Channel, switch-to-switch interfaces and switched backplanes.

Optical interface

Duplex LC receptacle per IEC 61754-20

1270 - 1355 nm transmitter · 10 km reach over single-mode fiber

Class 1 laser product · EN/IEC 60825-1

Electrical & management

20-contact SFP host interface · 3.3 V supply

2-wire serial interface · SFF-8472 digital diagnostics

TX_Disable, TX_Fault and LOS (TTL)

Power & environmental

1.0 W maximum power consumption

0 °C to +70 °C case temperature

RoHS: Pb, Hg, Cr6+, PBB, PBDE <1000 ppm · Cd <100 ppm

HARDWARE SPECIFICATION

Key specifications

Ordering & package

Part number	**DNOT00020**
Form factor	**SFP**
Optical interface	**Duplex LC**
Data rate	**1.25 / 1.0625 Gbps**
Reach	**10 km single-mode fiber**

Optical - transmitter

Average launch power (EOL)	**-9 to -3 dBm**
Center wavelength range	**1270 - 1355 nm**
Extinction ratio	**9 dB min**
Spectral width (RMS)	**4 nm max**
Total transmitter jitter	**0.284 UI max**
Optical rise / fall time	**260 ps max**

Optical - receiver

Center wavelength range	**1250 - 1620 nm**
Receiver sensitivity	**-20 dBm max**
Overload input optical power	**-3 dBm min**
LOS assert / de-assert	**-35 dBm min / -20 dBm max**
LOS hysteresis	**0.5 - 5 dB**

Electrical

Supply voltage (VCC)	**3.135 - 3.465 V**
Power consumption	**1.0 W maximum**
Supply current, Tx / Rx section	**300 mA max each**
Single-ended data input swing	**150 - 1100 mV**
Single-ended data output swing	**300 - 600 mV**

Environmental

Operating case temp	**0 °C - +70 °C**
Storage temperature	**-40 °C - +85 °C**
Relative humidity	**5% - 95%**
VCC absolute maximum	**-0.5 V - +4 V**

Management

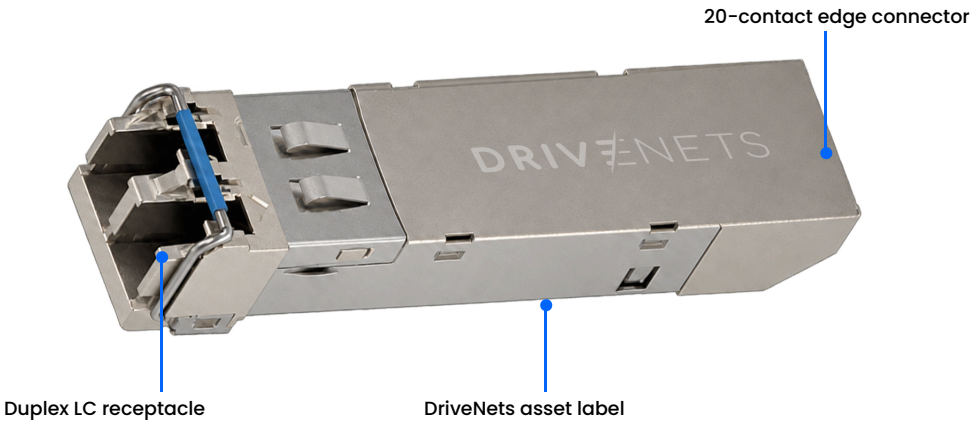
Host interface	**20-contact SFP connector**
Control	**2-wire serial (MOD-DEF1 / MOD-DEF2)**
Memory map	**INF-8074i · SFF-8472 Rev 12.4**

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 · FCC Class B

CENELEC EN55022 · VCCI Class 1

Immunity: IEC61000-4-3 Class 2

ESD immunity: IEC61000-4-2, LV 4

ESD & safety

ESD to electrical pins: MIL-STD-883E Method 3015.7 Class 1 (>1.5 kV) - Human Body Model

EN/IEC 60950-1 · UL

Laser safety & RoHS

Class 1 laser product: CDRH21-CFR 1040

EN/IEC 60825-1 · EN/IEC 60825-2

Complies with RoHS II Directive 2011/65/EU

RoHS test methods: BS EN 1122 · US EPA 3050B / 3052 / 3060A

1.25 Gbps
DATA RATE

10 km
REACH OVER SMF

Duplex LC
OPTICAL INTERFACE

1.0 W
MAXIMUM POWER

APPLICATIONS & STANDARDS

Applications

- Gigabit Ethernet
- Gigabit Fiber Channel
- Switch to switch interface
- Switched backplane

Reference documents

- Compliant with SFP MSA (INF-8074i)
- Compliant with SFF-8472 v12.4
- Compliant with IEEE 802.3z Gigabit Ethernet
- Compliant with FC-PI v2.0

RATINGS

Absolute maximum ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Storage temperature range	T_S	**-40**	**+85**	°C
Relative humidity	RH	**5**	**95**	%
Power supply voltage	V_{CC}	**-0.5**	**+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
Data rate	-	**-**	**1.25 / 1.0625**	**-**	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 INF-8074i and SFF-8472 rev 12.4.

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 (each lane)						
Average launch power (EOL)	P_o	**-9**		**-3**	dBm	
Center wavelength range	λ_c	**1270**		**1355**	nm	
Extinction ratio	ER	**9**			dB	
Spectral width (RMS)	$\Delta\lambda$			**4**	nm	
Total transmitter jitter	TJ			**0.284**	UI	1
Relative intensity noise	RIN			**-120**	dB/Hz	2
Optical rise / fall time	T_r / T_f			**260**	ps	3
Dispersion penalty	DP			**1**	dB	
Output power of OFF transmitter	P_{off}			**-45**	dBm	
Eye diagram		Complies with IEEE 802.3z eye mask when filtered				
Receiver (each lane)						
Center wavelength range	λ_c	**1250**		**1620**	nm	
Receiver sensitivity	S			**-20**	dBm	4
Overload input optical power	P_{in}	**-3**			dBm	
LOS de-assert	-			**-20**	dBm	
LOS assert	-	**-35**			dBm	
LOS hysteresis	-	**0.5**	**3**	**5**	dB	5

1. TP2 refers to the compliance point specified in IEEE 802.3z, section 38.2.1.
2. RIN is the laser noise, integrated over a specified bandwidth, measured relative to average optical power with 12 dB return loss. For multimode application, the RIN is better than -117 dB/Hz.
3. Optical transition time is the time interval required for the rising or falling edge of an optical pulse to transition between the 20% and 80% amplitudes relative to the logical 1 and 0 levels.
4. Measured with a PRBS 2²³-1 test pattern, @1.25 Gb/s, EX = 10 dB, BER < 10⁻¹².
5. The LOS hysteresis is to minimize “chatter” on the output line. In principle, hysteresis alone does not guarantee chatter-free operation.

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	
Power consumption	-			**1.0**	W	
Supply current (Tx section)	I_{CC}			**300**	mA	1
Supply current (Rx section)	I_{CC}			**300**	mA	1
Single-ended data input swing	-	**150**		**1100**	mV	
Single-ended data output swing	-	**300**		**600**	mV	
TX_Fault / LOS output (TTL)	V_{OH}	**2.0**		**Vcc**	V	
	V_{OL}	**0**		**0.8**	V	
TX_Disable input (TTL)	V_{IH}	**2.0**		**Vcc**	V	
	V_{IL}	**0**		**0.8**	V	

1. The supply current includes the SFP module supply current and the test board working current.

HOST INTERFACE

Pin assignment



Figure 1. SFP module pinout

SIGNALS

Pin description

NAME	PIN	DIRECTION	DESCRIPTION	NOTES
VeeT	1	Ground	Transmitter ground	
TX_Fault	2	Output	Transmitter fault indication	1
TX_Disable	3	Input	Transmitter disable; high or open = transmitter disabled	2
MOD-DEF2	4	Bidirectional	2-wire serial interface data line (SDA)	3
MOD-DEF1	5	Bidirectional	2-wire serial interface clock line (SCL)	3
MOD-DEF0	6	-	Module present; grounded inside the module	3
Rate_Select	7	-	Not connected	
LOS	8	Output	Loss of signal	4
VeeR	9	Ground	Receiver ground	
VeeR	10	Ground	Receiver ground	
VeeR	11	Ground	Receiver ground	
RD-	12	Output	Inverse received data out	5
RD+	13	Output	Received data out	5
VeeR	14	Ground	Receiver ground	
VccR	15	Power	Receiver power supply, +3.3 V	6
VccT	16	Power	Transmitter power supply, +3.3 V	6
VeeT	17	Ground	Transmitter ground	
TD+	18	Input	Transmitter data in	7
TD-	19	Input	Inverse transmitter data in	7
VeeT	20	Ground	Transmitter ground	

1. TX Fault is open collector/drain output which should be pulled up externally with a 4.7K - 10KΩ resistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to <0.8V.
2. TX Disable input is used to shut down the laser output per the state table below. It is pulled up within the module with a 4.7 - 10K resistor.
Low (0 - 0.8V): Transmitter on · Between (0.8V and 2V): Undefined · High (2.0 - VccT): Transmitter Disabled · Open: Transmitter Disabled
3. Mod-Def 0, 1, 2. These are the module definition pins. They should be pulled up with a 4.7 - 10K resistor on the host board to supply less than VccT+0.3V or VccR+0.3V.
Mod-Def 0 is grounded by the module to indicate that the module is present. Mod-Def 1 is clock line of two wire serial interface for optional serial ID. Mod-Def 2 is data line of two wire serial interface for optional serial ID.
4. LOS (Loss of signal) is an open collector/drain output which should be pulled up externally with a 4.7 - 10K resistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this output indicates the received optical power is below the worst case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to <0.8V.
5. RD-/+: These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω differential at the user SERDES. The AC coupling is done inside the module and thus not required on the host board.
6. VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V±5% at the SFP connector pin.
7. TD-/+: These are the differential transmitter inputs. They are AC coupled differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on host board.

ARCHITECTURE

Functional block diagram

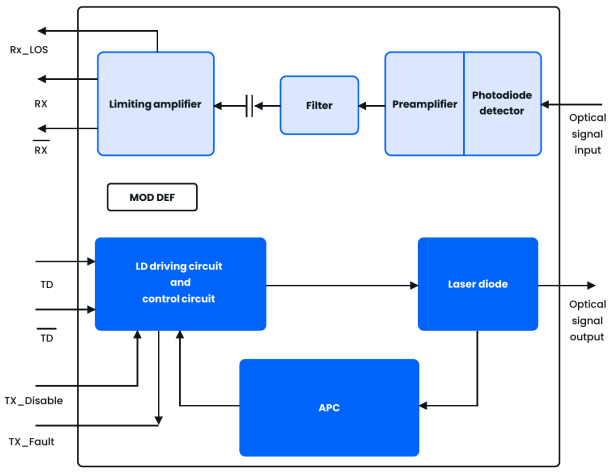


Figure 2. 1G SFP LX functional block diagram

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	Pb <1000ppm Cr6+ <1000ppm Hg <1000ppm PBB <1000ppm PBDE <1000ppm Cd <100ppm
Electrostatic discharge (ESD) to the electrical pins	MIL-STD-883E Method 3015.7	Class 1 (>1.5kV) - human body model
Electrostatic discharge (ESD) immunity	IEC61000-4-2	LV 4 (Air discharge: 15KV; contact discharge: 8KV) performance criterion: B
Electromagnetic interference (EMI)	CISPR22 ITE Class B FCC Class B CENELEC EN55022 VCCI Class 1	Compliant with standard
Immunity	IEC61000-4-3 Class 2	Typically show no measurable effect from a 3 V/m field swept from 80 to 1000MHz applied to the transceiver without a chassis enclosure.
	CDRH21-CFR 1040	Class 1 laser product
	EN/IEC 60825-1 EN/IEC 60825-2 EN/IEC 60950-1	Class 1 laser product
	UL	

MECHANICAL

Mechanical package outline

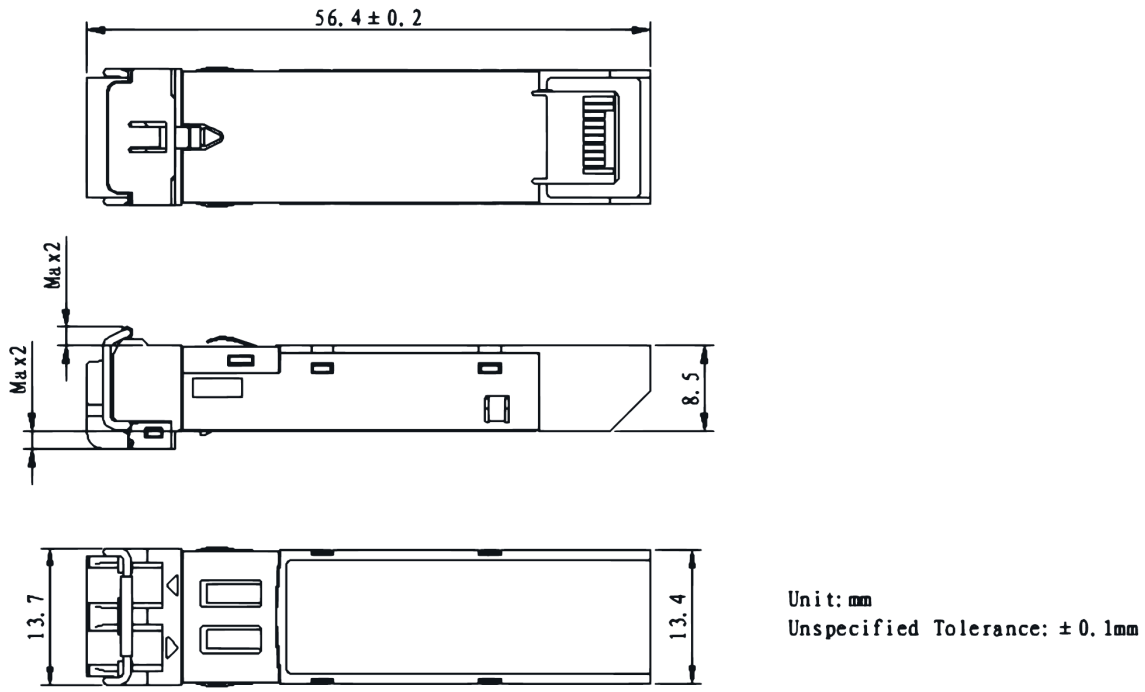


Figure 3. Mechanical package outline (all dimensions are in mm) · Unit: mm. Unspecified tolerance: ±0.1 mm.

FIBER INTERFACE

Optical interface

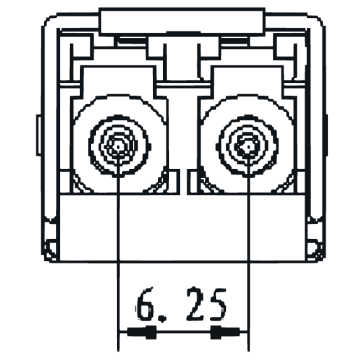


Figure 4. Optical receptacle.
The optical interface is a duplex LC receptacle compliant with IEC 61754-20.