

TSFP+ 10G DWDM 80 km 48CH Tunable Transceiver Module

Product Features

- SFP+ MSA compliant
- 48 channels (191.4~196.1 THz)
- 100 GHz channel spacing
- Maximum power consumption 2.5 W
- LC duplex connector
- Supports 9.8304 Gbps, 10.1376 Gbps, 10.3125 Gbps without CDR
- APD receiver
- Up to 80 km transmission on single mode fiber
- Operating case temperature: -20 to 85°C, cold start at -40°C
- Single 3.3 V power supply
- RoHS 2 compliant

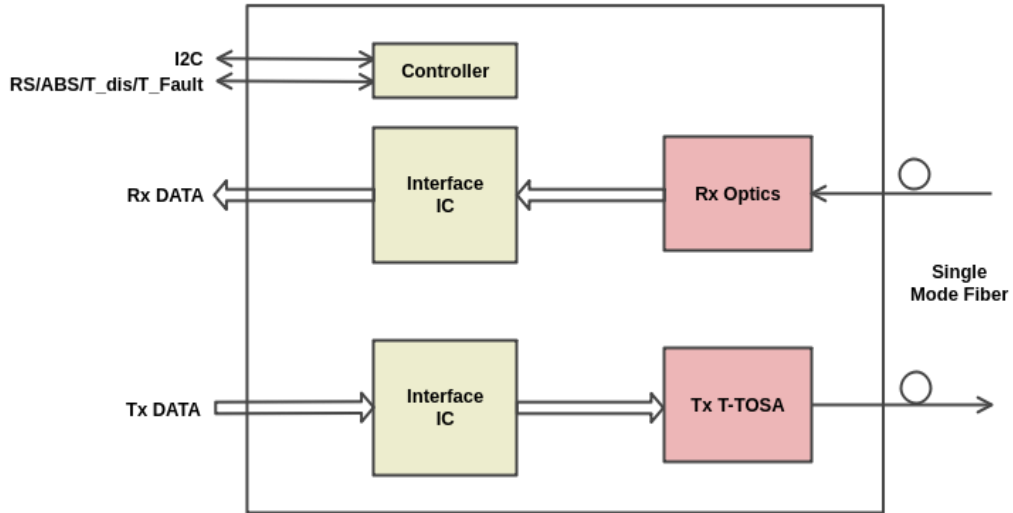
Applications

- 10G CPRI/eCPRI
- 10G Ethernet switches and routers

Descriptions

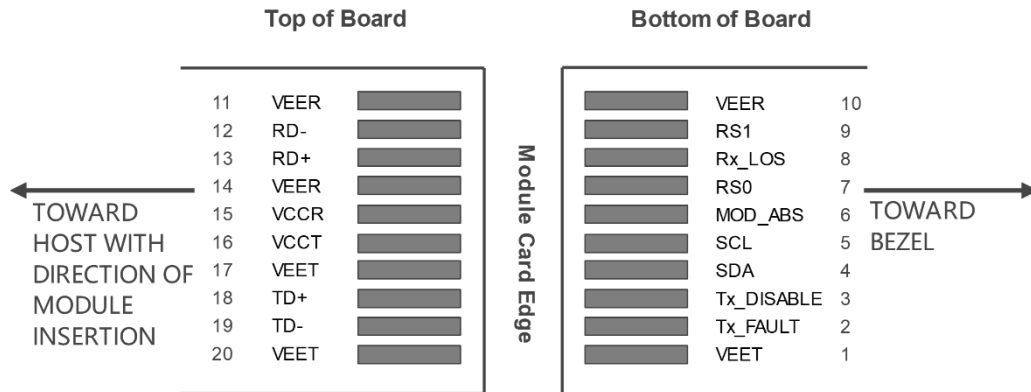
Luxglo's TSFP+C14H61 is a tunable transceiver module designed for 80 km optical communication applications, and it is compliant to SFP+ MSA standard. This module can convert a 10 Gbps electrical data to 10 Gbps optical signals. Similarly, it can convert a 10 Gbps optical input signal to 10 Gbps serial electrical data. It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference. The module offers very high functionality and feature integration, accessible via a two-wire serial interface.

Figure 1 Transceiver block diagram



Pin Descriptions

Figure 2 MSA compliant connector



Pin	Symbol	Description	Notes
1	VEET	Transmitter ground	1
2	TX_FAULT	Transmitter fault indication	
3	TX_DISABLE	Disables the transmitter or laser output	2
4	SDA	Data line for an I2C series interface	2
5	SCL	Clock line for an I2C series interface	2
6	MOD_ABS	Indicates the module online state (this pin is connected to the veet or veer pin)	
7	RS0	Selects a rate for the module (this pin is connected to	

Pin	Symbol	Description	Notes
		the 33 kilohm resistor)	
8	RX_LOS	Indicates a loss of received signals	2
9	RS1	Selects a rate for the module (this pin is connected to the 33 kilohm resistor)	
10	VEER	Receiver ground	1
11	VEER	Receiver ground	1
12	RD-	Inverse received data output	
13	RD+	Received data output	
14	VEER	Receiver ground	1
15	VCCR	3.3 V receiver power	1
16	VCCT	3.3 V transmitter power	1
17	VEET	Transmitter ground	1
18	TD+	Transmit data input	
19	TD-	Inverse transmit data input	
20	VEET	Transmitter ground	1

 **NOTE**

1. The ground of the module (operating module ground) and that of the module shell are separate from each other.
2. 4.7–10 kilohm resistor is used on the module to pull the output up to 3.15–3.45 V.

Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Maximum supply voltage	Vcc	0	3.3	3.6	V	
Storage temperature	Ts	-40		85	°C	
Relative humidity	RH	0		85	%	Non-condensing
Damage threshold, each lane	THd	0			dBm	

Operating Environments

Electrical and optical characteristics below are defined under this operating environment, unless otherwise specified.

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	Vcc	3.135	3.3	3.465	V
Case temperature	Top	-20		85	°C
Data rate		9.8304		10.3125	Gbps
Data rate accuracy		-100		100	ppm
Link distance with G.652				80	km

Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Power dissipation				2.5	W	1
Supply current	Icc			0.76	A	
Transmitter						
Data rate		9.8304		10.3125		
Differential voltage pk-pk	Vpp	180		900	mV	
Tx differential input impedance	ZIN		100		Ω	
Transmitter disable voltage	VD	2.0		Vcc+0.3	V	
Transmitter enable voltage	VEN	0		0.8	V	
Receiver						
Data rate		9.8304		10.3125		
Differential voltage pk-pk	Vpp	450	600	900	mV	
Rx differential output impedance	Zout		100		Ω	
LOS assert voltage	VLOSA	2.4		Vcc	V	
LOS de-assert voltage	VLOSD	Vee		Vee+0.4	V	

NOTE

1. Power dissipation is less than 2.5 W when supply voltage is 3.3 V/85°C, Power dissipation is less than 2.8W when supply voltage is 3.3 V/-20°C.

Optical Characteristics

Parameters	Unit	Min	Type	Max
Transmitter				
Output average power	dBm	0		4
Data rate		9.8304		10.3125
Data rate accuracy	ppm	-100		100
Wavelength range	THz	191.4		196.1
Wavelength accuracy	GHz	-12.5		12.5
Channel spacing	GHz		100	
Extinction ratio (ER)	dB	8.7		
TDP	dB			3
Side-mode suppression ratio (SMSR)	dB	30		
Rin ₁₂ OMA	dB/Hz			-130
Optical return loss tolerance	dB			12
Transmitter reflectance	dB			-26
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}			{0.25, 0.40, 0.45, 0.25, 0.28, 0.40}	
Receiver				
Data rate		9.8304		10.3125
Wavelength range	THz	191.4		196.1
Saturation power	dBm	-2		
Receiver sensitivity	dBm			-24
Receiver reflectance	dB			-26
LOS assert	dBm	-27		
LOS deassert	dBm			-19
LOS hysteresis	dB	0.5		

EEPROM Definitions

Page A0h

Address	Name of field	Description	Value (hex)	Notes
0	Identifier	Type of transceiver	0B	DWDM
1	Ext. Identifier	Extended identifier of type of transceiver	04	two-wire interface ID module
2	Connector	Code for connector type	07	LC Receptacle
3	Transceiver	10G Ethernet Compliance Codes InfiniBand Compliance Codes	05	10GBASE-ZR
4		ESCON Compliance Codes SONET Compliance Codes	00	
5		SONET Compliance Codes	00	
6		Ethernet Compliance Codes	00	
7		Fiber Channel Link Length Fiber Channel Technology	10	
8		Fiber Channel Technology SFP+ Cable Technology	10	
9		Fiber Channel Transmission Media	00	
10		Fiber Channel Speed	00	
11		Encoding	Code for high speed serial encoding algorithm	03
12	BR, Nominal	Nominal signaling rate, units of 100 MBd. (see details for rates > 25.4 Gbps)	67	>10.3125 Gbps
13	Rate Identifier	Type of rate select functionality	00	
14	Length (SMF, km)	Link length supported for single mode fiber, units of km	50	80 km
15	Length (SMF)	Link length supported for single mode fiber, units of 100 m		
16	Length (50 μm)	Link length supported for 50 μm OM2 fiber, units of 10 m	00	
17	Length (62.5 μm)	Link length supported for 62.5 μm OM1 fiber, units of 10 m	00	
18	Length (OM4 or copper cable)	Active cable link length, units of m	00	
19	Length (OM3)	Link length supported for 50 μm OM3 fiber, units of 10 m	00	

Address	Name of field	Description	Value (hex)	Notes
20-35	Vendor name	SFP+ vendor name (ASCII)	48 49 53 49 4C 49 43 4F 4E 20 20 20 20 20 20 20	LUXGLO
36	Transceiver	Code for electronic or optical compatibility	00	
37-39	Vendor OUI	SFP+ vendor IEEE company ID	00 00 00	
40-55	Vendor PN	Part number provided by SFP+ vendor (ASCII)	4F 4D 36 32 35 33 5A 58 32 30 30 20 20 20 20 20	TSFP+C14H61
56-59	Vendor rev	Revision level for part number provided by vendor (ASCII)	41 20 20 20	A
60-61	Wavelength	Laser wavelength (passive/active cable specification compliance)	00 00	Tunable
62	Unallocated		00	
63	CC_base	Check code for base ID fields (addresses 0 to 62)	Programmed by factory	
64	Options	Indicates which optional transceiver signals are implemented	34	Retime or CDR indicator, cooled transceiver, power level 3, limit receiver output;
65	Options	Indicates which optional transceiver signals are implemented	5A	Tunable, rate select, TX_DISABLE, TX_FAULT, Rx_LOS
66	BR, max	Upper bit rate margin, units of % (see details for rates > 25.4 Gbps)	00	
67	BR, min	Lower bit rate margin, units of % (see details for rates > 25.4 Gbps)	00	
68-83	Vendor SN	Serial number provided by vendor (ASCII)	Programmed by factory	
84-91	Date code	Vendor's manufacturing date code	Programmed by factory	
92	Diagnostic monitoring type	Indicates which type of diagnostic monitoring is implemented (if any) in the transceiver	68	1. Received power measurement type is average power

Address	Name of field	Description	Value (hex)	Notes
				2. Internally calibrated 3. DDM implemented
93	Enhanced options	Indicates which optional enhanced features are implemented (if any) in the transceiver	70	These functions implemented: 1. Soft TX_DISABLE control 2. Soft TX_FAULT monitoring 3. Soft RX_LOS monitoring 4. Soft RATE_SELECT control
94	SFF-8472 compliance	Indicates which revision of SFF-8472 the transceiver complies with	08	SFF-8472
95	CC_EXT	Check code for the extended ID fields (addresses 64 to 94)	Programmed by factory	
96-127	Vendor specific	Vendor specific EEPROM	Programmed by factory	

Digital Diagnostic Monitoring Functions

TSFP+C14H61 support the I2C-based Diagnostic Monitoring Interface (DMI) defined in document SFF-8472. The host can access real-time performance of transmitter and receiver optical power, temperature, supply voltage and bias current.

Performance item	Related bytes (a2h memory)	Monitor error	Notes
Module temperature	96 to 97	< +/-3°C	1, 2
Module voltage	98 to 99	< +/-3%	2
LD bias current	100 to 101	< +/-10%	2
Transmitter optical power	102 to 103	< +/-3 dB	2
Receiver optical power	104 to 105	< +/-3 dB	2

NOTE

- Actual temperature test point is fixed on module case around Laser.
- Full operating temperature range.

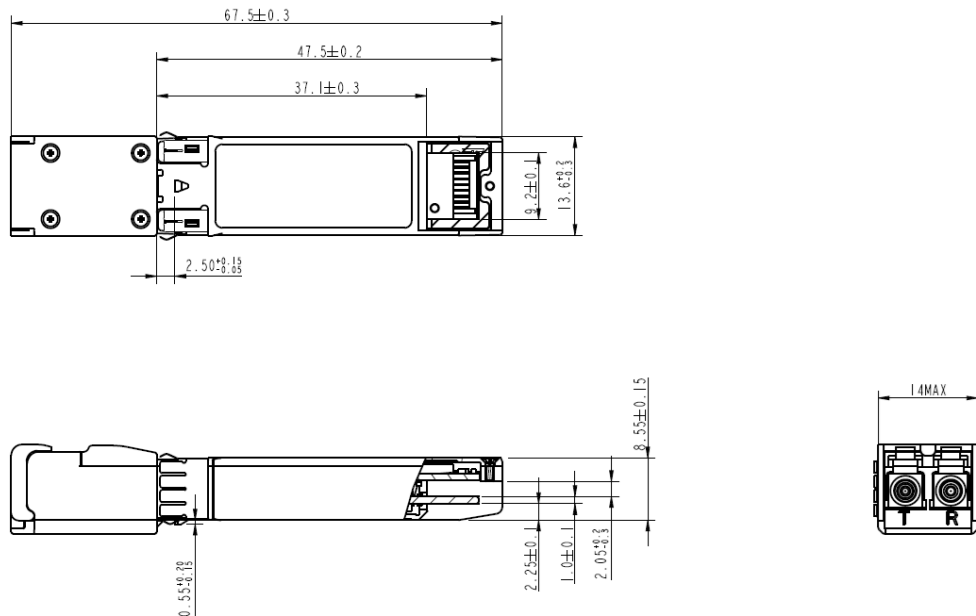
Alarm and Warning Thresholds

TSFP+C14H61 support alarms function, indicating the values of the preceding basic performance are lower or higher than the thresholds.

Performance item	Alarm threshold bytes (a2h memory)	Unit	Low threshold	High threshold
Temp alarm	00 to 03	°C	-30	95
Temp warning	04 to 07	°C	-20	85
Voltage alarm	08 to 11	V	2.97	3.63
Voltage warning	12 to 15	V	3.135	3.465
Bias alarm	16 to 19	mA	1	80
Bias warning	20 to 23	mA	2	70
TX power alarm	24 to 27	dBm	-3	8
TX power warning	28 to 31	dBm	0	5
RX power alarm	32 to 35	dBm	-28	0
RX power warning	36 to 39	dBm	-25	-2

Mechanical Specifications

Figure 3 Mechanical dimensions



Regulatory Compliance

Feature	Agency	Standard	Performance
Safety	NRTL	UL 62368-1 CAN/CSA C22.2 No. 62368-1 IEC 60825-1 IEC 60825-2	NRTL recognized component for US and CAN
	TUV	EN 62368-1 EN 60825-1 EN 60825-2	TUV certificate
	FDA	U.S. 21 CFR 1040.10 & 1040.11	FDA/CDRH certified with accession number according to Laser Notice 56
Electromagnetic Compatibility	Radiated emissions	EMC Directive 2014/30/EU EN 55032 CISPR 32 FCC rules 47 CFR Part 15 ICES-003 VCCI-CISPR 32 AS/NZS CISPR 32	Class B digital device with a minimum -6 dB margin to the limit when tested with a metal enclosure. Final margin may vary depending on system application, good system EMI design practice, i.e.: suitable metal enclosure and well-bonding, is required to achieve Class B margins at the system level. Tested frequency range: 30 MHz to 40 GHz or 5th harmonic (5 times the highest frequency), whichever is less.
	ESD	EMC Directive 2014/30/EU EN 55035 CISPR 35 IEC/EN 61000-4-2	Withstands discharges of ± 8 kV contact, ± 15 kV air.
	Radiated immunity	EMC Directive 2014/30/EU EN 55035 CISPR 35 IEC/EN 61000-4-3	Field strength of 10 V/m from 80 MHz to 6 GHz.
Restriction of Hazardous Substances	RoHS	EU RoHS (2011/65/EU & (EU) 2015/863) & UK RoHS EN IEC 63000:2018 & BS EN IEC 63000:2018	

ESD Design

Normal ESD precautions are required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and otherwise handled in an ESD protected environment utilizing standard grounded benches, floor mats, and wrist straps.

Parameter	Threshold value	Notes
ESD of high-speed pins	1 kV	Human body model
ESD of low-speed pins	2 kV	Human body model
Air discharge during operation	15 kV	
Direct contact discharges to the case	8 kV	

Safety Specification Design

 **CAUTION**

Do not look into fiber end faces without eye protection using an optical meter (such as magnifier and microscope) within 100 mm, unless you ensure that the laser output is disabled. When operating an optical meter, observe the operation requirements.

CAUTION—Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Ordering Information

Part number	Description
TSFP+C14H61	TSFP+ 10G 80 km C-Band 48CH Tunable