

## LWO-SFPP-ER-31

### 10 Gbit SFP+, 1310nm, 40km, DDM, LC-Duplex, Singlemode

#### Features

- Up to 11.3Gb/s data links
- 1310nm DFB transmitter and PIN receiver
- Up to 40km on 9/125µm SMF
- Hot-pluggable SFP+ footprint
- Duplex LC/UPC type pluggable optical interface
- RoHS-10 compliant and leadfree
- Support Digital Monitoring interface
- Single +3.3V power supply
- Compliant with SFF+MSA and SFF-8472
- Metal enclosure, for lower EMI
- Meet ESD requirements, resist 8KV direct contact voltage
- Case operating temperature:
  - Commercial: 0°C to +70°C
  - Industrial: -40°C to +85°C

#### Application

- 10GBASE-ER/EW & 10G Ethernet
- SDH STM64
- Other Optical Links



#### General Description

The LWO-SFPP-ER31 SFP+ transceiver is designed for use in 10-Gigabit Ethernet links up to 40km over single mode fiber. The module consists of 1310nm DFB Laser, PIN and Preamplifier in a high-integrated optical sub-assembly. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472.

LWO-SFPP-ER31 transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, and received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The SFP+ MSA defines a 256-byte memory map in EEPROM that is accessible over a 2-wire serial interface at the 8bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged.

#### 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.	Max.	Units	Notes
Storage Temperature	$T_s$	-40	85	degC	
Power Supply Voltage	$V_{CC}$	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	5	95	%	
Damage Threshold	$TH_d$	5		dBm	

#### Recommended Operating Conditions and Power Supply Requirements

Parameter	Symbol	Min.	Typical	Max.	Units	Notes
Case Operating Temperature	$T_{TOP}$	0		70	°C	commercial
		-40		85	°C	industrial
Power Supply Voltage	$V_{CC}$	3.135	3.3	3.465	V	
Data Rate			10.3125		Gbps	
Control Input Voltage High		2		$V_{CC}$	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			40	km	9/125µm

## LWO-SFPP-ER-31

### 10 Gbit SFP+, 1310nm, 40km, DDM, LC-Duplex, Singlemode

#### Pin Assignment and Description

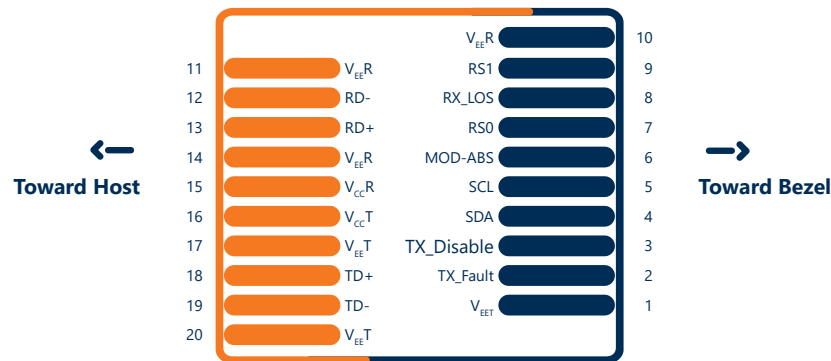


Figure 1. MSA Compliant Connector

#### PIN Definition

PIN	Logic	Symbol	Name/Description	Notes
1		V <sub>EE</sub> T	Transmitter Ground (Common with Receiver Ground)	1
2	LVTTTL-O	TX <sub>FAULT</sub>	Transmitter Fault	2
3	LVTTTL-I	TX <sub>DISABLE</sub>	Transmitter Disable. Laser output disabled on high or open	3
4	LVTTTL-I/O	SDA	2-wire Serial Interface Data Line	4
5	LVTTTL-I/O	SCL	2-wire Serial Interface Clock Line	4
6		MOD_ABS	Module Absent. Grounded within the module	4
7	LVTTTL-I	RS0	Rate Select 0, internal pull down	5
8	LVTTTL-O	LOS	Loss of Signal indication. Logic 0 indicates normal operation	6
9	LVTTTL-I	RS1	Rate Select 1, internal pull down	5
10		V <sub>EE</sub> R	Receiver Ground (Common with Transmitter Ground)	1
11		V <sub>EE</sub> R	Receiver Ground (Common with Transmitter Ground)	1
12	CML-O	RD-	Receiver Inverted DATA out. AC Coupled	
13	CML-O	RD+	Receiver Non-inverted DATA out. AC Coupled	
14		V <sub>EE</sub> R	Receiver Ground (Common with Transmitter Ground)	1
15		V <sub>CC</sub> R	Receiver Power Supply	
16		V <sub>CC</sub> T	Transmitter Power Supply	
17		V <sub>EE</sub> T	Transmitter Ground (Common with Receiver Ground)	1
18	CML-I	TD+	Transmitter Non-Inverted DATA in. AC Coupled	
19	CML-I	TD-	Transmitter Inverted DATA in. AC Coupled	
20		V <sub>EE</sub> T	Transmitter Ground (Common with Receiver Ground)	1

#### Notes

- Circuit ground is internally isolated from chassis ground.
- TFAULT is an open collector/drain output, which should be pulled up with a 4.7kΩ-10kΩ resistor on the host board if intended for use. Pull up voltage should be between 2.0V to V<sub>cc</sub> + 0.3V. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
- Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
- Should be pulled up with 4.7kΩ-10kΩ on host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
- Internally pulled down per SFF-8431 Rev 4.1.
- LOS is open collector output. It should be pulled up with 4.7kΩ-10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

## LWO-SFPP-ER-31

### 10 Gbit SFP+, 1310nm, 40km, DDM, LC-Duplex, Singlemode

#### Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Power Consumption	P			1.5	W	
Supply Current	$I_{CC}$			450	mA	
<b>Transmitter</b>						
Single-ended Input Voltage Tolerance	$V_{CC}$	-0.3		4.0	V	
AC Common Mode Input Voltage Tolerance (RMS)		15			mV	
Differential Input Voltage Swing	$V_{IN}$ pp	120		820	mV pp	
Differential Input Impedance	$Z_{IN}$	90	100	110	Ohm	1
Transmit Disable Assert Time				10	us	
Transmit Disable Voltage	$V_{dis}$	$V_{CC}-1.3$		$V_{CC}$	V	
Transmit Enable Voltage	$V_{en}$	$V_{ee}$		$V_{ee}+0.8$	V	2
<b>Receiver</b>						
Differential Output Voltage Swing	$V_{OUT}$ pp	350		850	mV pp	
Differential Output Impedance	$Z_{out}$	90	100	110	Ohm	3
Data output rise/fall time	$T_r/T_f$	28			ps	4
LOS Assert Voltage	$V_{losH}$	$V_{CC}-1.3$		$V_{CC}$	V	5
LOS De-assert Voltage	$V_{losL}$	$V_{ee}$		$V_{ee}+0.8$	V	5
Power Supply Rejection	PSR	100			mV pp	6

#### Notes

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. Input 100 ohms differential termination.
4. These are unfiltered 20-80% values.
5. Loss of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

## LWO-SFPP-ER-31

### 10 Gbit SFP+, 1310nm, 40km, DDM, LC-Duplex, Singlemode

#### Optical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
<b>Transmitter</b>						
Center Wavelength	$\lambda$	1260	1310	1355	nm	1
Optical Spectral Width	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Optical Power	$P_{AVG}$	-1		3	dBm	2
Extinction Ratio	ER	3.5			dB	
Transmitter and Dispersion Penalty	TDP			3.2	dB	
Transmitter OFF Output Power	Poff			-30	dBm	
Transmitter Eye Mask	Compliant with IEEE802.3ae					
<b>Receiver</b>						
Center Wavelength	$\lambda_c$	1270		1610	nm	
Sensitivity (Average Power)	Sen.			-15	dBm	3
Input Saturation Power (Overload)	$P_{SAT}$	-0.5			dBm	
LOS Assert	LOSA	-30			dBm	
LOS De-assert	LOSD			-17	dBm	
LOS Hysteresis	LOSH	0.5			dB	

#### Notes

- Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
- Launched power (avg.) is power coupled into a single mode fiber with master connector (Before of Life).
- Measured with Light source 1310nm, ER=3.5dB; BER $\leq$ 1E-12 @10.3125Gbps, PRBS=2<sup>31</sup> -1 NRZ.

#### Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales staff.

Parameter	Symbol	Min.	Max.	Units	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	°C	Over operating temp
Supply voltage monitor absolute error	$D_{MI\_VCC}$	-0.15	0.15	V	Full operating range
RX power monitor absolute error	DMI_RX	-3	3	dB	
Damage Threshold	DMI_bias	-10%	10%	mA	
TX power monitor absolute error	DMI_TX	-3	3	dB	

# LWO-SFPP-ER-31

## 10 Gbit SFP+, 1310nm, 40km, DDM, LC-Duplex, Singlemode

### Mechanical Dimensions

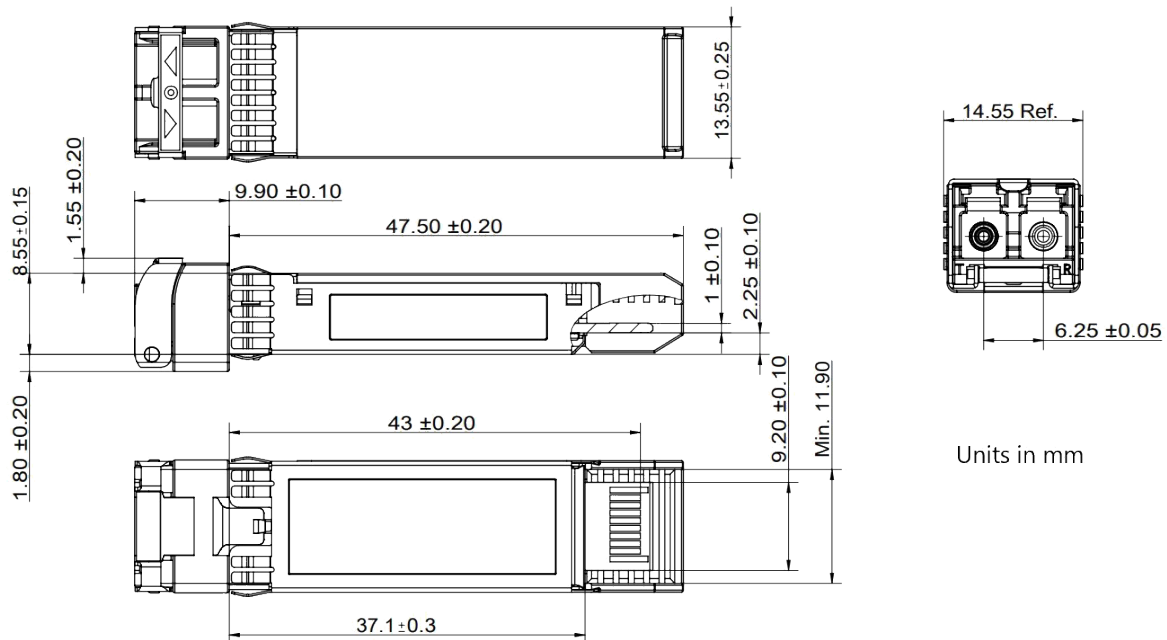


Figure 2. Mechanical Outline

### ESD

This transceiver is specified as ESD threshold 1kV for high speed data pins and 2kV for all other electrical input pins, tested per MIL-STD-883, Method 3015.4 / JESD22- A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

### Laser Safety

This is a Class 1 Laser Product according to EN 60825-1:2014. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007).

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