

Data Sheet

# 10Gb/s 1550nm SFP+ ER 40km Transceiver

P/N: WST-SFP+ER-x



## Features:

- Up to 11.3Gbps Data Links
- Up to 40km transmission on SMF
- EML transmitter and PIN receiver
- Metal enclosure for lower EMI
- 2-wire interface with integrated Digital Diagnostic monitoring Specifications compliant with SFF-8472
- Compliant with SFP+ MSA SFF-8431 with LC connector
- Single 3.3V power supply
- Case operating temperature range:  
0°C to 70°C, 1.5W power dissipation for WST-SFP+ER-C  
-40°C to 85°C, 1.8W power dissipation for WST-SFP+ER-I
- RoHS Compliant.

## Applications:

- 10GBASE-ER/EW & 10G Ethernet

Wavesplitter WST-SFP+ER-x series SFP+ transceiver is designed for use in 10-Gigabit Ethernet links up to 40km over single mode fiber. The module consists of 1550 EML 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. The module data link up to 40km in 9/125um single mode fiber.

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Storage Temperature	Ts	-40	-	85	°C	
Relative Humidity	RH	5	-	95	%	
Power Supply Voltage	VCC	-0.3	-	4	V	
Signal Input Voltage		Vcc-0.3	-	Vcc+0.3	V	

**Recommended Operating Conditions**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Case Operating Temperature	Tcase	0		70	°C	WST-SFP+ER-C
		-40		85		WST-SFP+ER-I
Power Supply Voltage	VCC	3.14	3.3	3.47	V	
Power Supply Current	ICC			500	mA	WST-SFP+ER-C
				550		WST-SFP+ER-I
Data Rate	BR	24.3	25.78	26.5	Gbps	
Transmission Distance	TD		-	40	km	
Coupled fiber	Single mode fiber					9/125um SMF

**Electrical Characteristics**

Parameter	Symbol	Min	Typ	Max	Unit	NOTE
Supply Voltage	Vcc	3.14	3.3	3.46	V	
Supply Current (Note 1)	Icc			450	mA	WST-SFP+ER-C
				550		WST-SFP+ER-I
Transmitter						
Input differential impedance	Rin		100		Ω	2
Single ended data input swing	Vin-pp	180		700	mV	
Transmit Disable Voltage	VDis	2.0		Vcc	V	3
Transmit Enable Voltage	VEN	Vee		Vee+ 0.8	V	
Receiver						
Differential data output swing	Vout-pp	400		800	mV	4
LOS output high level	VLOS-H	2.0		VCCHOST	V	5
LOS output low level	VLOS-L	Vee		Vee+0.8	V	5

**Notes**

1. Measured with receive Pin=Psен, Vcc=3.3V, operation temperature range, without air flow
2. Connected directly to TX data input pins. AC coupled .
3. Or open circuit.
4. Into 100 ohms differential termination.
5. Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

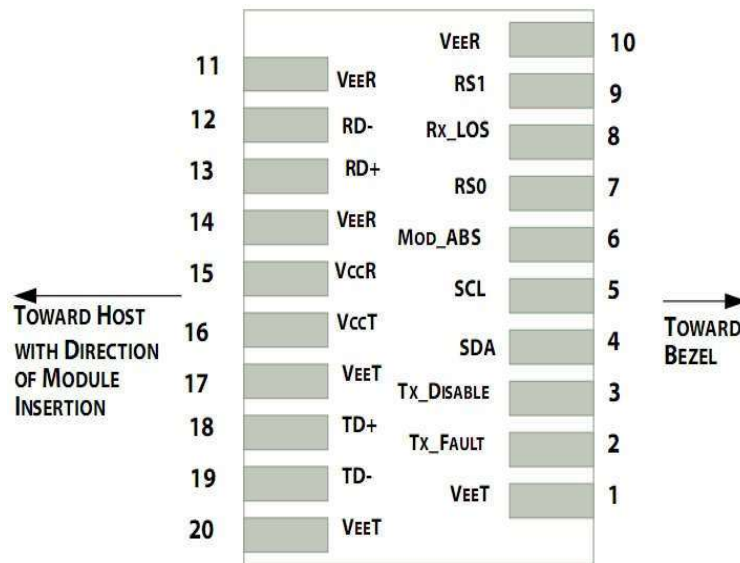
**Optical Characteristics**

Parameter	Symbol	Min	Typ.	Max.	Unit	Note
Transmitter						
Average Launched Power	PO	-1		+3	dBm	Note (1)
Extinction Ratio	ER	8.2			dB	Note (2)
Center Wavelength	λc	1530	1550	1565	nm	
Spectrum Band Width (-20dB)	σ			1.0	nm	
SMSR		30			dB	
Transmitter OFF Output Power	P <sub>Off</sub>			-30	dBm	
Transmitter and Dispersion Penalty	TDP			2.0	dB	
Output Eye Mask	Compliant with IEEE 802.3ae					
Receiver						
Input Optical Wavelength	λ	1270		1610	nm	
Receiver Sensitivity	P <sub>sen</sub>			-16.0	dBm	Note (3)
Input Saturation Power (Overload)	P <sub>sat</sub>	0			dBm	
LOS Assert	LOSA	-30			dBm	
LOS De-assert	LOSD			-17	dBm	
LOS Detect Hysteresis	P <sub>hys</sub>	0.5			dB	

Note:

- 1 Launched power (avg.) is power coupled into a single mode fiber with master connector.
- 2 Measured with test signal@10.3125Gbps, PRBS=2<sup>31</sup>-1,NRZ,O/E module Keysight 86105D with filter 10.3125Gb/s (ER>8.2dB, at least 1dB lower than Keysight 86105D measurement when using Agilent 86105C)
- 3 Measured with conformance test signal for BER = 10<sup>-12</sup>.@10.3125Gbps, PRBS=2<sup>31</sup>-1,NRZ : Optical source with worst ER , Wavelength between 1530nm and 1565nm : back to back

## Pin Assignment



Pin out of Connector Block on Host Board

Pin	Symbol	Name/Description	NOTE
1	T <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault.	2
3	T <sub>DIS</sub>	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	4
5	SCL	2-wire Serial Interface Clock Line	4
6	MOD_ABS	Module Absent. Grounded within the module	4
7	RS0	no connection	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	5
9	RS1	Internally connect to circuit ground	
10	VEER	Receiver Ground (Common with Transmitter Ground)	1
11	VEER	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out. AC Coupled	
13	RD+	Receiver Non-inverted DATA out. AC Coupled	
14	VEER	Receiver Ground (Common with Transmitter Ground)	1
15	VCCR	Receiver Power Supply	
16	VCC T	Transmitter Power Supply	
17	VEET	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in AC Coupled.	

19	TD-	Transmitter Inverted DATA in AC Coupled.	
20	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1

## Notes:

1. Circuit ground is internally isolated from chassis ground.
2. TFAULT is an LVTTTL output. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power or the laser temperature exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
3. Laser output disabled on T<sub>DIS</sub> > 2.0V or open, enabled on <0.8V.
4. Should be pulled up with 4.7kΩ- 10kΩ on host board to a typical 3.3V voltage. MOD\_ABS pulls low to indicate module is plugged in.
5. LOS is open collector output. It should be pulled up with 4.7kΩ – 10kΩ on host board to a typical 3.3V voltage. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

### Digital Diagnostic Functions

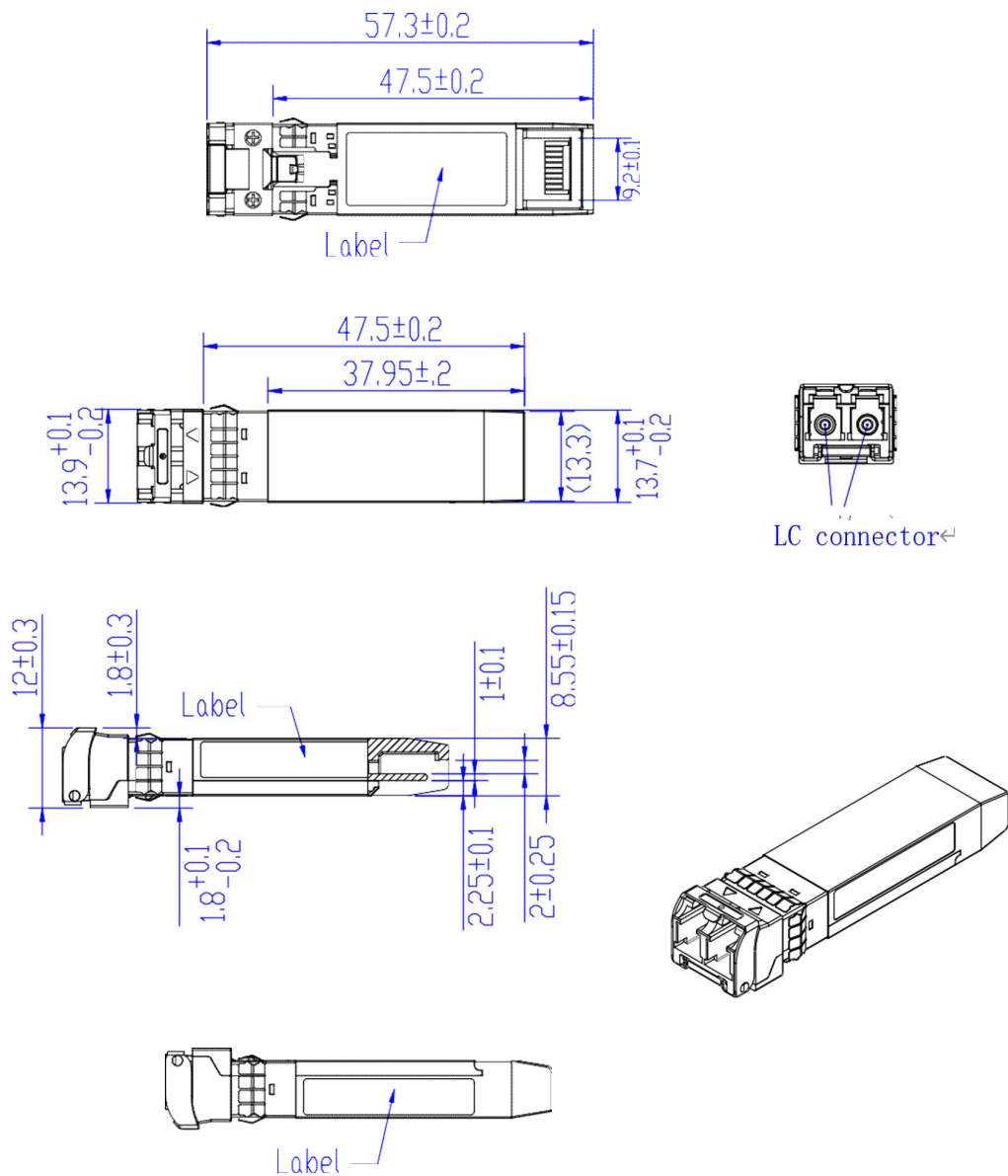
Wavesplitter WST-SFP+ER-C serial transceivers support the 2-wire serial communication protocol as defined in the SFP+MSA. The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

Additionally, Wavesplitter SFP+ 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, 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 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

The schematic diagram illustrates the electrical connections for an ABS module. It features two main sections: the top section for the Laser Driver and Laser Diode, and the bottom section for the Linearity Amplifier and Photo Diode. The Laser Driver is connected to VccT and Tx\_Disable, and drives the Laser Diode. The Linearity Amplifier is connected to VccR and Tx\_Disable, and drives the Photo Diode. The Protocol IC is connected to Vcc and Tx\_Disable, and provides Tx\_Fault, TD+, TD-, VeeT, VeeR, RD+, RD-, Rx\_LOS, MOD\_ABS, RS0, and RS1 signals. The 3202601 chip is connected to Vcc, Tx\_Disable, Tx\_Fault, TD+, TD-, VeeT, VeeR, RD+, RD-, Rx\_LOS, MOD\_ABS, RS0, RS1, and Mod def 1/Mod def 0 signals. The diagram also shows various passive components like resistors (4.7K-10K, 10K, 100 Ohm, >30K) and capacitors (0.1uF, 10uF).

**Mechanical Drawing**

**Ordering Information**

Part No	Specification									
	Package	Data rate per Lane	Laser	Optical Power	Detector	Receive Sensitivity (OMA)	Temp	Reach	Other	Application code
WST-SFP+ER-C	SFP+	10.3125 Gbps each Channel	1550nm EML	-1 ~ +3 each Channel	PIN	-16 dBm each Channel	0~70°C	40km	DDM RoHS	10G Ethernet
WST-SFP+ER-I	SFP+	10.3125 Gbps each Channel	1550nm EML	-1 ~ +3 each Channel	PIN	-16 dBm each Channel	-40~85°C	40km	DDM RoHS	10G Ethernet

**Modification History**

Revision	Date	Description	Originator	Review	Approved
V1.0	25-Sep-2020	New Issue	Elma Yueh	Wayne Liao	Wayne Liao



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