Waveform Technology Product Specification

of

10 Gbps SFP+ DWDM ZR 80 km Optical Transceiver

1. General Description

The Waveform's SFP+ DWDM ZR optical transceivers are designed for 10 Gbps serial optical interfaces for data communications with singlemode fiber (SMF). The transceiver can support 1.25 Gbps to 11.1 Gbps. The transceiver designs are optimized for high performance and cost effective to supply customers the best solutions for datacom and storage applications.

2. Features

- SFP MSA package with duplex SMF LC connector
- Center Wavelength 1550nm
- CWDM LD for the transmitter and APD for the receiver
- Very low EMI and excellent ESD protection
- Digital Diagnostic Monitor Interface
- Hot pluggable
- 10 Gbps serial optical interface
- Up to 80 Km distance
- Compliant with SFP+ MSA
- High transmission margin
- +3.3V single power supply
- Below <1.8 W power consumption
- SFP mechanical interface
- SFP+ MSA Compliant
- SFF-8472 reversion 9.5 compliant
- IEEE802.3-2005 compliant :10-Gigabit Ethernet
- Telcordia GR-468-CORE compliant
- FCC 47 CFR Part 15,Class B compliant
- FDA 21 CFR 1040.10 and 1040.11,class1 compliant
- RoHS compliant

3. Applications

- 10G Base-ZR/ZW
- 10G Fiber Channel
- Optical Links

Waveform Technology
19F., No.258 sec. 2, Jincheng Rd., Tucheng Dist., New Taipei City 236, Taiwan
TEL:+886-2-22601657 FAX: +886-2-82613871
http://www.waveform.com.tw E-mail: sales@waveform.com.tw

4. Absolute Ratings

Absolute Maximum Ratings					
Parameter	**Symbol**	**Min.**	**Max.**	**Unit**	**Note**
Supply Voltage	Vcc	-0.5	4.0	V	
Storage Temperature		-40	85	°C	
Relative Humidity			85	%	

Note: Stress in excess of the maximum absolute ratings can cause permanent damage to the module.

5. Specification

Recommended Operating Conditions							
Parameter		**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**	**Note**
Data Rate	Ethernet			10.3125		Gbps	
	SDH / Sonet			9.953			
Supply Voltage		Vcc	3.13	3.3	3.47	V	
Supply Current		Icc			500	mA	
Operating Case Temp.		Tc	-40		85	°C	

Optical Characteristics						
Transmitter						
Parameter	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**	**Note**
Operating Wavelength	λc	λc -0.1		λc +0.1	nm	
Ave. output power (Enabled)	Po	0		+5	dBm	1
Central Wavelength Spacing			100		GHz	
Extinction Ratio	ER	6			dB	1
Side Mode Suppression Ratio	SMSR	30			nm	
Dispersion penalty				3	dB	
Output Optical Eye	IEEE 802.3-2005 Compliant					
Optical Characteristics						
Receiver						

Waveform Technology
19F., No.258 sec. 2, Jincheng Rd., Tucheng Dist., New Taipei City 236, Taiwan
TEL:+886-2-22601657 FAX: +886-2-82613871
http://www.waveform.com.tw E-mail: sales@waveform.com.tw

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Wavelength	λ	1480		1580	nm	
Sensitivity	Psen			-23	dBm	2
Min. overload	Pimax	-7			dBm	
LOS Assert	Pa	-32			dBm	
LOS De-assert	Pd			-26	dBm	
LOS Hysteresis	Pd-Pa	0.5		4	dB	

Note 1) Measured at 10.3125 Gbps with PRBS 2^{31} – 1 NRZ test pattern.

Note 2) Under the ER worst case, measured at 10.3125 Gbps with PRBS 2^{31} - 1 NRZ test pattern for BER < $1x10^{-12}$

Electrical Input/Output Characteristics

Transmitter

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
Diff. input voltage swing			120		820	mVpp	1
Tx Disable input	H	VIH	2.0		Vcc+0.3	V	
	L	VIL	0		0.8		
Tx Fault output	H	VOH	2.0		Vcc+0.3		
	L	VOL	0		0.8	V	2
Input Diff. Impedance		Zin		100		Ω	

Electrical Input/Output Characteristics

Receiver

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
Diff. output voltage swing			340	650	800	mVpp	3
Rx LOS Output	H	VOH	2.0		Vcc+0.3	V	2
	L	VOL	0		0.8		

Note 1) TD+/- are internally AC coupled with 100Ω differential termination inside the module.

Note 2) Tx Fault and Rx LOS are open collector outputs, which should be pulled up with 4.7k to 10kΩ resistors on the host board. Pull up voltage between 2.0V and Vcc+0.3V.

Note 3) RD+/- outputs are internally AC coupled, and should be terminated with 100Ω (differential) at the user SERDES.

Waveform Technology
19F., No.258 sec. 2, Jincheng Rd., Tucheng Dist., New Taipei City 236, Taiwan
TEL:+886-2-22601657 FAX: +886-2-82613871
http://www.waveform.com.tw E-mail: sales@waveform.com.tw

Serial Interface for ID and DDM

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP MSA. The serial ID information of the SFP modules and Digital Diagnostic Monitor parameters can be accessed through the I2C interface at address A0h and A2h. The memory is mapped in Table 1. Detailed ID information(A0h) is listed in Table 2. And the DDM specification (A2h) is described in Table 3. For more details of the memory map and byte definitions, please refer to the SFF-8472 (Rev 9.3, Aug. 2002), "Digital Diagnostic Monitoring Interface for Optical Transceivers". **The DDM parameters have been internally calibrated.**

Table 1. Digital Diagnostic Memory Map (Specific Data Field Descriptions)

2 wire address 1010000X (**A0h**)	
Address	**Information**
0~95	Serial ID Defined by SFP MSA (96 bytes)
96~127	Vendor Specific (32 bytes)
128~255	Reserved,SFF8079 (128 bytes)

2 wire address 1010001X (**A2h**)	
Address	**Information**
0~55	Alarm and Warning Thresholds (56 bytes)
56~95	Calibration Constants (40 bytes)
96~119	Real Time Diagnostic Interface (24 bytes)
120~127	Vender Specific (8 bytes)
128~247	User Writable EEPROM (120 bytes)
248~255	Vender Specific (8 bytes)

Waveform Technology
19F., No.258 sec. 2, Jincheng Rd., Tucheng Dist., New Taipei City 236, Taiwan
TEL:+886-2-22601657 FAX: +886-2-82613871
http://www.waveform.com.tw E-mail: sales@waveform.com.tw

6. PIN Assignment

Pin	Symbol	Name/Description	Note
1	VEET	Transmitter Ground (Common with Receiver Ground)	1
2	TFAULT	Transmitter Fault.	2
3	TDIS	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	Rate Select 0	5
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	6
9	RS1	No connection required	1
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	VCCT	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	VEET	Transmitter Ground (Common with Receiver Ground)	1

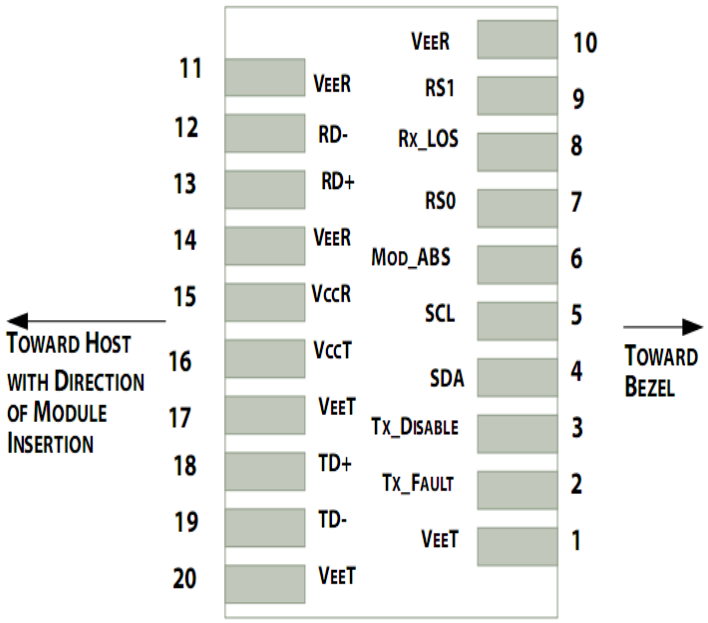
Notes:

1. Circuit ground is internally isolated from chassis ground.
2. TFAULT is an open collector/drain output, which should be pulled up with a 4.7kΩ– 10 kΩ resistor on the host board if intended for use. Pull up voltage should be between 2.0V to Vcc + 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.
3. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
4. Should be pulled up with 4.7kΩ- 10kΩ on host board to a voltage between 2.0V and 3.6V. MOD_ABS

Waveform Technology
19F., No.258 sec. 2, Jincheng Rd., Tucheng Dist., New Taipei City 236, Taiwan
TEL:+886-2-22601657 FAX: +886-2-82613871
http://www.waveform.com.tw E-mail: sales@waveform.com.tw

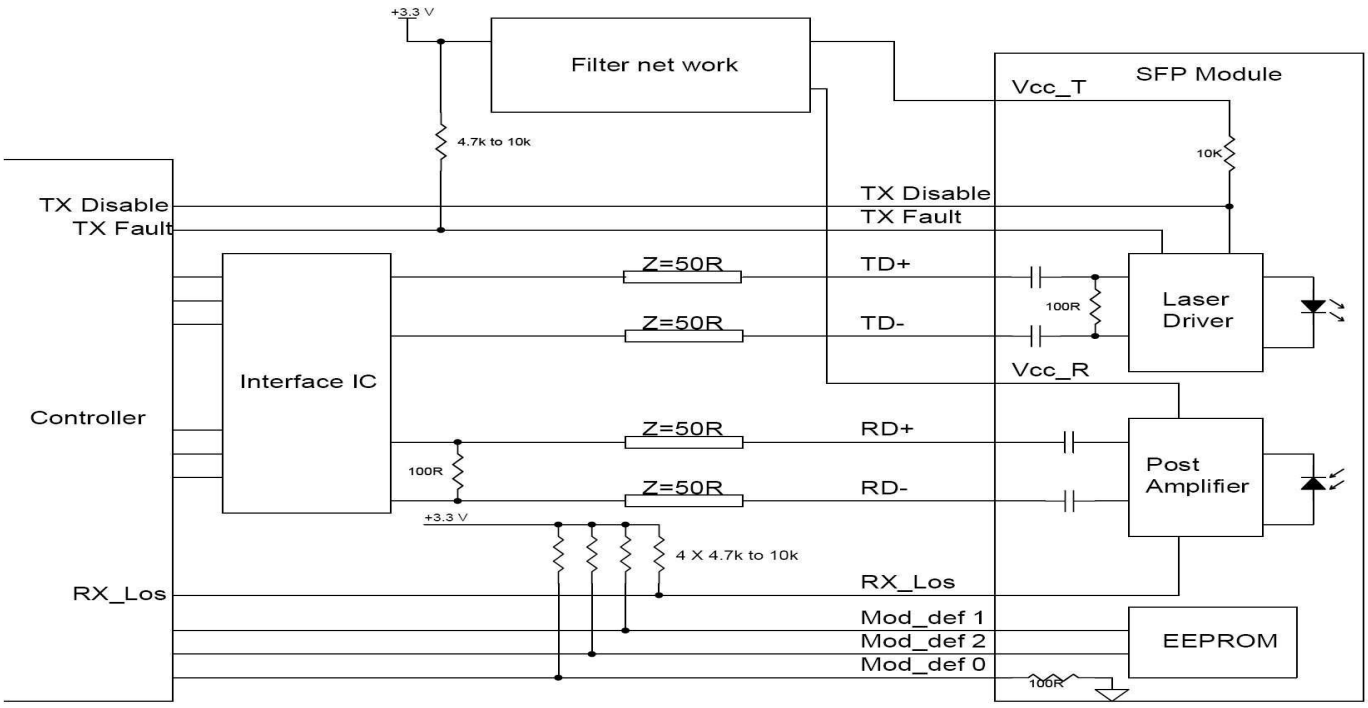
pulls line low to indicate module is plugged in.

5. Internally pulled down per SFF-8431 Rev 4.1.
6. 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.

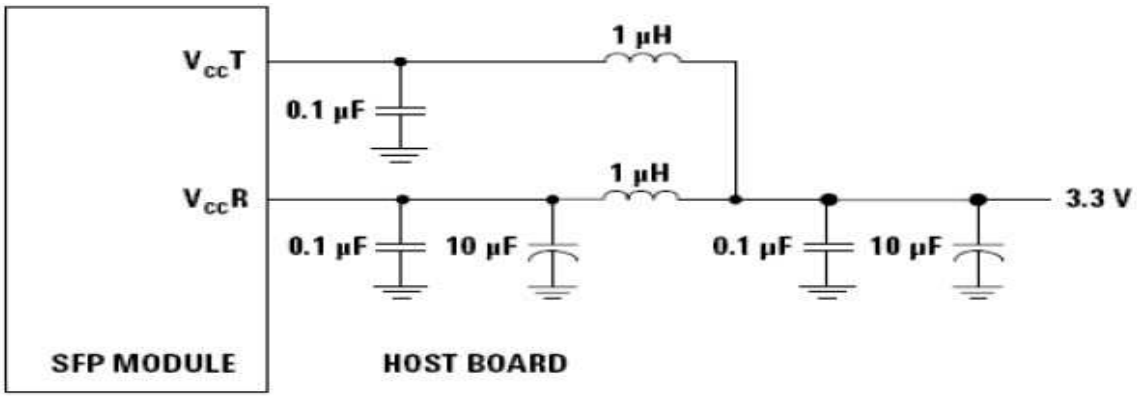


Waveform Technology
19F., No.258 sec. 2, Jincheng Rd., Tucheng Dist., New Taipei City 236, Taiwan
TEL:+886-2-22601657 FAX: +886-2-82613871
http://www.waveform.com.tw E-mail: sales@waveform.com.tw

7. Recommend Circuit



Recommended power supply filter



Note: Inductors with DC resistance of less than 1Ω should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30 mA greater than the steady state value

Waveform Technology
19F., No.258 sec. 2, Jincheng Rd., Tucheng Dist., New Taipei City 236, Taiwan
TEL:+886-2-22601657 FAX: +886-2-82613871
http://www.waveform.com.tw E-mail: sales@waveform.com.tw

Ordering Information

2.7.5

10 Gbps DWDM SFP+ DDM Internally Calibrated

P/N	Frequency (THz)	Λc (nm)	ITU Channel	Temp. ℃
F418L274917-D	191.7	1563.86	C17	-40 ~ +85
F418L274918-D	191.8	1563.05	C18	-40 ~ +85
F418L274919-D	191.9	1562.23	C19	-40 ~ +85
F418L274920-D	192.0	1561.42	C20	-40 ~ +85
F418L274921-D	192.1	1560.61	C21	-40 ~ +85
F418L274922-D	192.2	1559.79	C22	-40 ~ +85
F418L274923-D	192.3	1558.98	C23	-40 ~ +85
F418L274924-D	192.4	1558.17	C24	-40 ~ +85
F418L274925-D	192.5	1557.36	C25	-40 ~ +85
F418L274926-D	192.6	1556.55	C26	-40 ~ +85
F418L274927-D	192.7	1555.75	C27	-40 ~ +85
F418L274928-D	192.8	1554.94	C28	-40 ~ +85
F418L274929-D	192.9	1554.13	C29	-40 ~ +85
F418L274930-D	193.0	1553.33	C30	-40 ~ +85
F418L274931-D	193.1	1552.52	C31	-40 ~ +85
F418L274932-D	193.2	1551.72	C32	-40 ~ +85
F418L274933-D	193.3	1550.92	C33	-40 ~ +85
F418L274934-D	193.4	1550.12	C34	-40 ~ +85
F418L274935-D	193.5	1549.32	C35	-40 ~ +85
F418L274936-D	193.6	1548.51	C36	-40 ~ +85
F418L274937-D	193.7	1547.72	C37	-40 ~ +85
F418L274938-D	193.8	1546.92	C38	-40 ~ +85
F418L274939-D	193.9	1546.12	C39	-40 ~ +85
F418L274940-D	194.0	1545.32	C40	-40 ~ +85
F418L274941-D	194.1	1544.53	C41	-40 ~ +85
F418L274942-D	194.2	1543.73	C42	-40 ~ +85
F418L274943-D	194.3	1542.94	C43	-40 ~ +85
F418L274944-D	194.4	1542.14	C44	-40 ~ +85
F418L274945-D	194.5	1541.35	C45	-40 ~ +85
F418L274946-D	194.6	1540.56	C46	-40 ~ +85

Waveform Technology
19F., No.258 sec. 2, Jincheng Rd., Tucheng Dist., New Taipei City 236, Taiwan
TEL:+886-2-22601657 FAX: +886-2-82613871
http://www.waveform.com.tw E-mail: sales@waveform.com.tw

F418L274947-D	194.7	1539.77	C47	-40 ~ +85
F418L274948-D	194.8	1538.98	C48	-40 ~ +85
F418L274949-D	194.9	1538.19	C49	-40 ~ +85
F418L274950-D	195.0	1537.40	C50	-40 ~ +85
F418L274951-D	195.1	1536.61	C51	-40 ~ +85
F418L274952-D	195.2	1535.82	C52	-40 ~ +85
F418L274953-D	195.3	1535.04	C53	-40 ~ +85
F418L274954-D	195.4	1534.25	C54	-40 ~ +85
F418L274955-D	195.5	1533.47	C55	-40 ~ +85
F418L274956-D	195.6	1532.68	C56	-40 ~ +85
F418L274957-D	195.7	1531.90	C57	-40 ~ +85
F418L274958-D	195.8	1531.12	C58	-40 ~ +85
F418L274959-D	195.9	1530.33	C59	-40 ~ +85
F418L274960-D	196.0	1529.55	C60	-40 ~ +85
F418L274961-D	196.1	1528.77	C61	-40 ~ +85

Waveform Technology
19F., No.258 sec. 2, Jincheng Rd., Tucheng Dist., New Taipei City 236, Taiwan
TEL:+886-2-22601657 FAX: +886-2-82613871
http://www.waveform.com.tw E-mail: sales@waveform.com.tw

8. Caution

Laser Safety

This laser based multimode transceiver is a Class 1 product. It complies with IEC 60825-1 Ed.2: 2007 and FDA performance standards for laser products (21 CFR 1040.10 and 1040.11) except for deviations pursuant to Laser Notice 50, dated June 24, 2007.

ESD

This transceiver is specified as ESD threshold 1kV for SFI pin and 2kV for all others 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.

When the ambient is reaching 85C max as declared, the internal case is hot surface please don't touch.

9. Service Contact

Please contact us :

Waveform Technology Co., Ltd.
19F, No.258 sec. 2 Jincheng Rd.,
Tucheng Dist., New Taipei City 236,
Taiwan

TEL:+886-2-22601657
FAX: +886-2-82613871
e-mail: sales@waveform.com.tw
http://www.waveform.com.tw

10. Record of Revisions

Record of Revisions		
Rev.	**Date**	**Description of Change**
VER R1A	2014.12.12	Original Specification issued.

Waveform Technology
19F., No.258 sec. 2, Jincheng Rd., Tucheng Dist., New Taipei City 236, Taiwan
TEL:+886-2-22601657 FAX: +886-2-82613871
http://www.waveform.com.tw E-mail: sales@waveform.com.tw