

# 10Gb/s SFP+ CWDM 1470-1610nm 100km Optical Transceiver

## Features

- Up to 100km on 9/125µm SMF
- Up to 11.3Gb/s data links
- CWDM EML transmitter and APD receiver
- Hot-pluggable SFP+ footprint
- Compliant with SFF+MSA and SFF-8472
- Duplex LC/UPC type pluggable optical interface
- RoHS-10 compliant and lead-free
- Support Digital Diagnostic Monitoring interface
- Hot pluggable
- Metal enclosure, for lower EMI
- Meet ESD requirements, resist 8KV direct contact voltage
- +3.3V power supply
- Operating case temperature: 0~+70°C

## Applications

- 10GBASE-ZR/ZW & 10G Ethernet
- SDH STM64
- Other Optical Links

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## Compliance

- Compliant with IEEE 802.3ae-2002
- Compliant with MSA SFF-8472
- Compliant with MSA SFF-8431

## Description

The SFP-10G-CW100 transceivers are designed for use in 10-Gigabit Ethernet links up to 100km over single mode fiber. The module consists of CWDM EML Laser, APD 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.

SFP-10G-CW100 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 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.

## Wavelength

Table1-Wavelength			
Wavelength	Clasp Color Code	Wavelength	Clasp Color Code
1470	Gray	1550	Yellow
1490	Purple	1570	Orange
1510	Blue	1590	Red
1530	Green	1610	Brown

## Absolute Maximum Ratings

Table2-Absolute Maximum Ratings				
Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T <sub>s</sub>	-40	+85	°C
Power Supply Voltage	V <sub>cc</sub>	-0.5	3.6	V
Relative Humidity (non-condensation)	RH	5	95	%
Damage Threshold	TH <sub>d</sub>	0		dBm

## Recommended Operating Conditions and Power Supply Requirements

Table3-Recommended Operating Conditions and Power Supply Requirements						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	T <sub>op</sub>	0		+70	°C	

Power Supply Voltage	VCC	3.135	3.3	3.465	V	
Data Rate			10.3125		Gb/s	
Control Input Voltage High		2		Vcc	V	
Control Input Voltage Low		0		0.8	V	
Link Distance (SMF)	D			100	km	9/125 $\mu$ m

## Electrical Characteristics

Table4-Electrical Characteristics						
Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Power Consumption	p			1.6	W	
Supply Current	Icc			450	mA	
Transmitter						
Single-ended Input Voltage Tolerance	Vcc	-0.3		4.0	V	
AC Common Mode Input Voltage Tolerance (RMS)		15			mV	
Differential Input Voltage Swing	Vin,pp	180		1200	mVpp	
Differential Input Impedance	Zin	90	100	110	Ohm	1
Transmit Disable Assert Time				10	us	
Transmit Disable Voltage	Vdis	Vcc-1.3		Vcc	V	
Transmit Enable Voltage	Ven	Vee		Vee +0.8	V	2
Receiver						
Differential Output Voltage Swing	Vout,pp	300		850	mVpp	
Differential Output Impedance	Zout	90	100	110	Ohm	3
Data output rise/fall time	Tr/Tf	28			ps	4
LOS Assert Voltage	VlosH	Vcc-1.3		Vcc	V	5
LOS De-assert Voltage	VlosL	Vee		Vee +0.8	V	5
Power Supply Rejection	PSR	100			mVpp	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 LVTTL. 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.

## Optical Characteristics

Table5-Optical Characteristics						
Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Transmitter						
Center Wavelength	$\lambda_c$	$\lambda -6.5$		$\lambda +6.5$	nm	1
Optical Spectral Width	$\Delta \lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Optical Power	P <sub>AVG</sub>	1		5	dBm	2
Optical Extinction Ratio	ER	8.2			dB	
Transmitter and Dispersion Penalty	TDP			3.0	dB	
Relative Intensity Noise	RIN			-128	dB/Hz	
Transmitter Eye Mask	Compliant with IEEE802.3ae					
Receiver						
Center Wavelength	$\lambda_c$	1270		1610	nm	
Receiver Sensitivity (Average Power)	Sen.			-25	dBm	3
Input Saturation Power (overload)	Psat	-8			dBm	
Receiver Reflectabce	Rrx			-27		
LOS Assert	LOSA	-35			dBm	
LOS De-assert	LOSD			-27	dBm	
LOS Hysteresis	LOSH	0.5			dB	

Notes:

[1]  $\lambda$  refer to wavelength selection, 1470~1610nm please the "product selection.

[2] Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.

[3] Measured with Light source 1470~1610nm, ER=8.2dB; BER =  $\leq 10^{-12}$  @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.

Table6-Digital Diagnostic Functions					
Parameter	Symbol	Min.	Max.	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temp
Supply voltage monitor absolute error	DMI_VCC	-0.15	0.15	V	Full operating range
RX power monitor absolute error	DMI_RX	-3	3	dB	
Bias current monitor	DMI_bias	-10%	10%	mA	
TX power monitor absolute error	DMI_TX	-3	3	dB	

## Pin Description

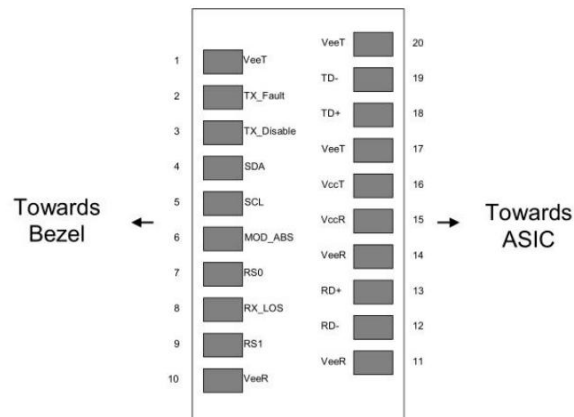


Figure1 Pin view

## Pin Function Definitions

Table7-Pin Function Definitions			
Pin	Symbol	Name/Description	Note
1	VeeT	Module Transmitter Ground	1
2	TX_Fault	Module Transmitter Fault	2
3	TX_Dis	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	4
6	MOD_ABS	Module Absent, connected to VeeT or VeeR in the module	4
7	RS0	Not used	5
8	RX_LOS	Receiver Loss of Signal Indication Active High	6
9	RS1	Not used	
10	VeeR	Module Receiver Ground	1
11	VeeR	Module Receiver Ground	1
12	RD-	Receiver Inverted Data Output	
13	RD+	Receiver Data Output	
14	VeeR	Module Receiver Ground	1
15	VccR	Module Receiver 3.3 V Supply	
16	VccT	Module Receiver 3.3 V Supply	
17	VeeT	Module Transmitter Ground	1
18	TD+	Transmitter Non-Inverted Data Input	
19	TD-	Transmitter Inverted Data Input	
20	VeeT	Module Transmitter 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 4.7k -10k Ohms 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 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.

## Mechanical Dimensions

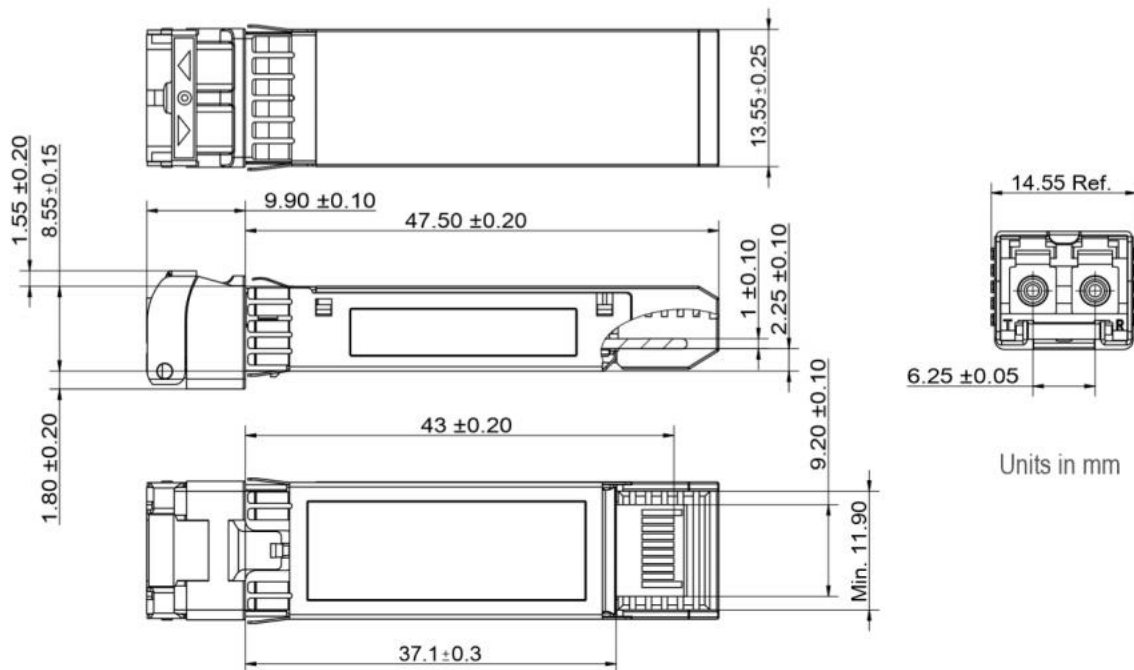


Figure2 Mechanical Outline

## Precautions

- a. This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.
- b. Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

## Further Information:

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Web [www.naddod.com](http://www.naddod.com)

Email For order requirements: [sales@naddod.com](mailto:sales@naddod.com)  
For customer service: [support@naddod.com](mailto:support@naddod.com)  
For technical support: [tech@naddod.com](mailto:tech@naddod.com)

For cooperation: [agency@naddod.com](mailto:agency@naddod.com)

For other informations: [info@naddod.com](mailto:info@naddod.com)

## Disclaimer

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