

Features

- From 24.3Gb/s Up to 28.1Gb/s data links
- CWDM DFB laser, PIN photo-detector
- Electrical interface compliant to SFF-8431 Specifications.
- 2-wire interface for management specifications compliant with SFF 8472 digital diagnostic monitoring interface for optical transceivers
- Operating case temperature:
 - (Commercial) 0°C to +70°C
 - (Industrial) -40°C to +85°C
- Advanced firmware allow customer system encryption information to be stored in transceiver
- Cost effective SFP28 solution, enables higher port densities and greater bandwidth
- RoHS compliant



Applications

- High-speed storage area networks
 - Computer cluster cross-connect
 - Custom high-speed data pipes
- Wireless base station system

Description

This CWDM DFB 28Gigabit SFP28 transceiver is designed to transmit and receive optical data over single mode optical fiber.

The SFP28 module electrical interface is compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI.

The transmitter converts 28Gbit/s serial CML electrical data into serial optical data. An open collector compatible Transmit Disable (Tx_Dis) is provided. Logic "1" or no connection on this pin will disable the laser from transmitting. Logic "0" on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (Tx_Fault) is provided. TX_Fault is module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX_Fault output contact is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7-10 kΩ. TX_Disable is

a module input contact. When TX_Disable is asserted high or left open, the SFP28 module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 k Ω to 10 k Ω resistor

The receiver converts 28Gbit/s serial optical data into serial CML electrical data. An open collector compatible Loss of Signal is provided. Rx_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and shall be pulled up to Vcc_Host in the host with a resistor in the range 4.7-10 k Ω , or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx_LOS signal is intended as a preliminary indication to the system in which the SFP28 is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Note
Storage Temperature	T_s	-40	85	°C	
Operating Case Temperature	T_c	0	70	°C	Commercial
	T_i	-40	85	°C	Industrial
Supply Voltage	V_{cc}	0	3.6	V	
Relative Humidity	RH	5	95	%	
Damage Threshold	THd	3.5	-	dBm	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
Case Operating Temperature	T_c	0		70	°C	Commercial
	T_i	-40		85	°C	Industrial
Power Supply Voltage	V_{cc}	3.135	3.3	3.465	V	
Data Rate, each Lane		24.3	25.78125		Gb/s	
Data Rate Accuracy		-100		100	ppm	
Control Input Voltage High		2		V_{cc}	V	
Control Input Voltage Low		0		0.8	V	
Link Distance with G.652	D	0.002		10	km	1

Notes:

1. When long distance is used, it is recommended to use FEC to guarantee the link budget.

Diagnostics

Parameter	Symbol	Accuracy	Unit	Notes
Temperature monitor absolute error	DMI_Temp	± 3	°C	Over operating Temp
Supply voltage monitor absolute error	DMI_VCC	±0.1	V	Full operating range
RX power monitor absolute error	DMI_RX	± 2 dB	dB	1 3.5dBm to -18dBm range
Bias Current monitor	DMI_Ibias	± 10%	mA	
Laser power monitor absolute error	DMI_TX	± 2 dB	dB	1

Notes:

1. Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

Transmitter Electro-optical Characteristics

$V_{CC} = 3.135\text{ V to } 3.465\text{ V}$, $T_C = 0^\circ\text{C to } 70^\circ\text{C}$ ($-40^\circ\text{C to } 85^\circ\text{C}$)

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Power Consumption				1500	mW	
Supply Current	I_{CC}			450	mA	
Single Ended Input Voltage Tolerance		-0.3		4	V	
AC Common mode voltage tolerance		15			mV	RMS
Differential Input Voltage Swing	V_{in}	180		700	mV	
Differential Input Impedance	Z_{in}	90	100	110	ohm	
Center Wavelength	λ_t	Ref order information			nm	
Center Wavelength Stability	$\Delta\lambda_D$	-6.5		6.5	nm	
Side Mode Suppression Ratio	$SMSR$	30			dB	
Average Optical Power	P_{avg}	-2.5		2.5	dBm	1
Laser Off Power	P_{off}			-30	dBm	
Optical Modulation Amplitude	OMA	-2			dBm	
Launch power in OMA minus TDP	$OMA-TDP$	-3			dBm	
Extinction Ratio	ER	4	---		dB	
Eye Mask Margin	EMM	10			%	1000 Waveform
Optical Return Loss Tolerance				12	dB	
Relative Intensity Noise	RIN_{20-OMA}			-130	dB/Hz	

Note:

1. Average optical power shall be measured using the methods specified in TIA/EIA-455-95.

Receiver Electro-optical Characteristics

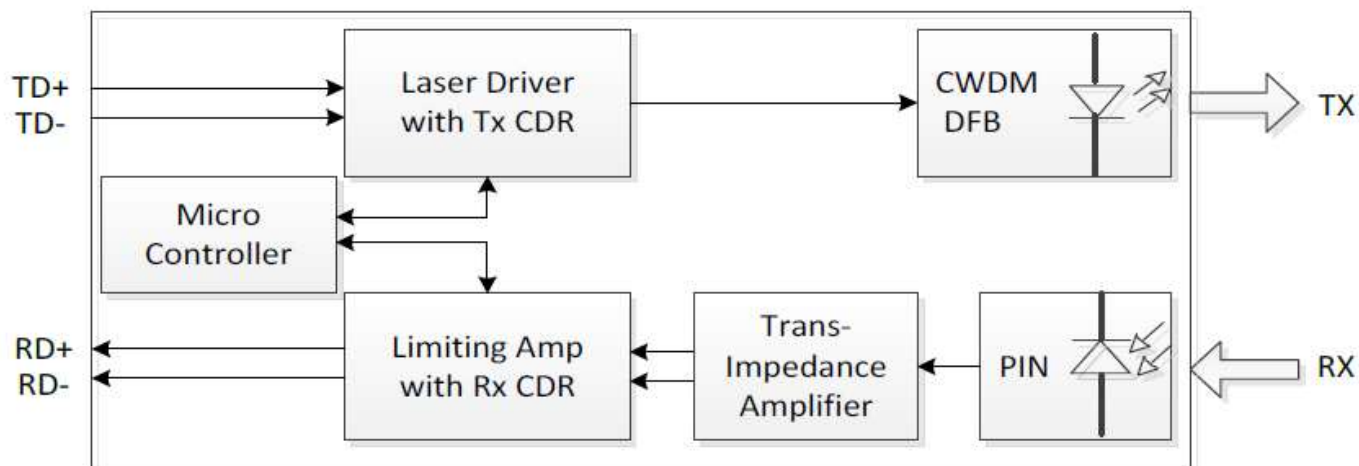
$V_{CC} = 3.135\text{ V to } 3.465\text{ V}$, $T_C = 0\text{ }^{\circ}\text{C to } 70\text{ }^{\circ}\text{C}$ (-40 °C to 85 °C)

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Single-ended Output Voltage		-0.3	-	4	V	
Differential Output Voltage Swing	V_o	300		850	mV	
AC Common Mode Output Voltage				7.5	mV	RMS
Differential Output Impedance	Z_{out}	90	100	110	ohm	
Center Wavelength	λ_r	1260		1350	nm	
Sensitivity (Average power)	P_{sens}			-10.3	dBm	1
Unstressed receiver sensitivity(OMA)	$P_{sens-OMA}$			-11.6	dBm	1
				-14.6	dBm	2
LOS Assert	$LOSA$	-30			dBm	
LOS Deassert	$LOSD$			-13	dBm	
LOS Hysteresis	$LOSH$	0.5			dB	
Return loss of receiver				-26	dB	
Average received power (overload)				2.5	dBm	1

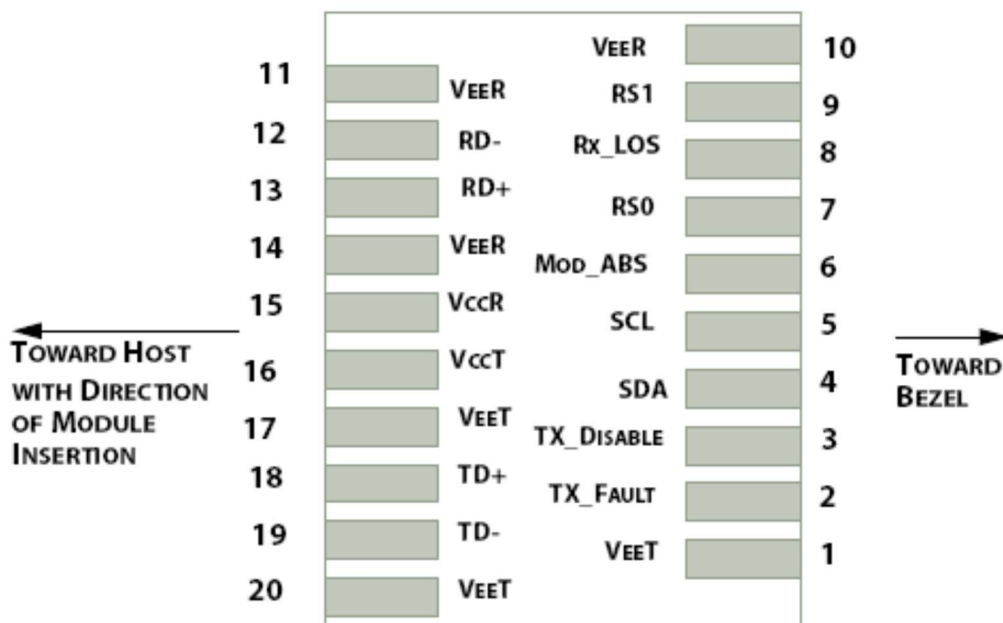
Note:

1. BER is less than 1E-12.
2. BER is less than 5E-5.

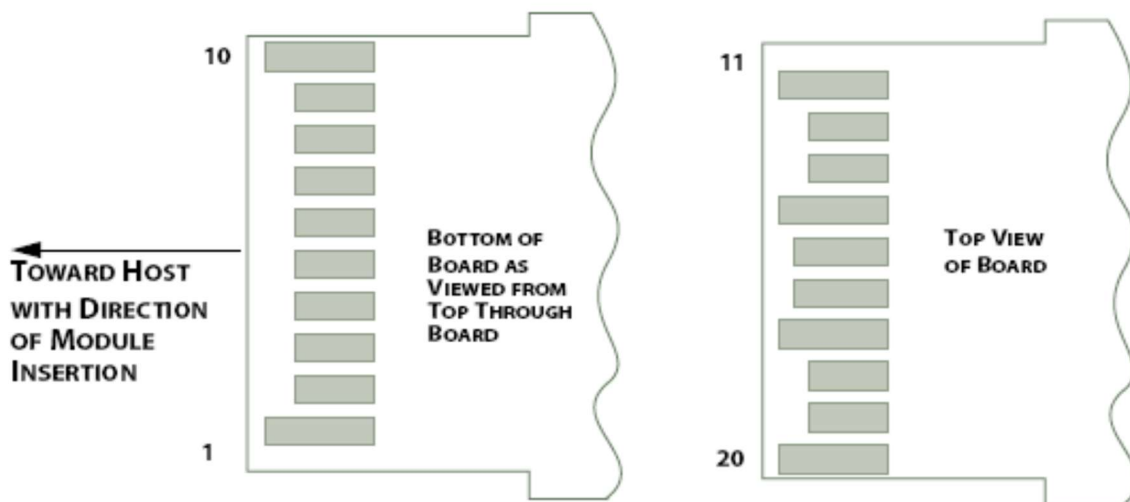
Block Diagram of Transceiver



Pin Assignment



Module Interface to Host



Module Contact Assignment

Pin Descriptions

<i>PIN</i>	<i>Logic</i>	<i>Symbol</i>	<i>Name / Description</i>	<i>Note</i>
1		VeeT	Module Transmitter Ground	1
2	LVTTL-O	TX_Fault	Module Transmitter Fault	
3	LVTTL-I	TX_Dis	Transmitter Disable; Turns off transmitter laser output	
4	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	2
5	LVTTL-I	SCL	2-Wire Serial Interface Clock	2
6		MOD_DEF0	Module Definition, Grounded in the module	
7	LVTTL-I	RS0	Receiver Rate Select	
8	LVTTL-O	RX_LOS	Receiver Loss of Signal Indication Active LOW	
9	LVTTL-I	RS1	Transmitter Rate Select (not used)	
10		VeeR	Module Receiver Ground	1
11		VeeR	Module Receiver Ground	1
12	CML-O	RD-	Receiver Inverted Data Output	
13	CML-O	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	CML-I	TD+	Transmitter Non-Inverted Data Input	
19	CML-I	TD-	Transmitter Inverted Data Input	
20		VeeT	Module Transmitter Ground	1

Note:

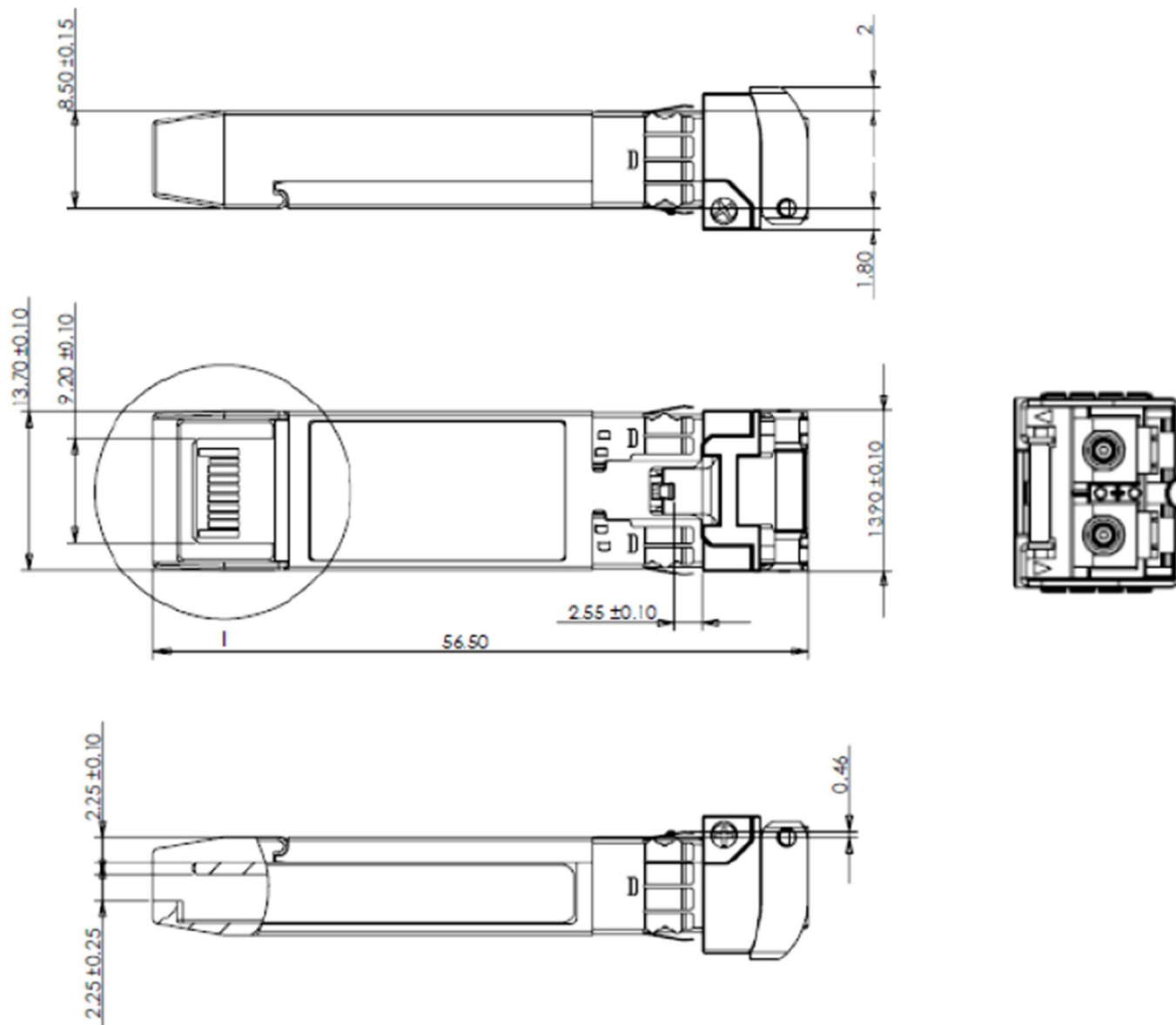
1. Module ground pins GND are isolated from the module case.2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.
2. Shall be pulled up the voltage between 3.15V and 3.47V with 4.7K – 10Kohms on the host board.

Control and Status I/O Timing Characteristics

Timing characteristics of control and status I/O are compatible with SFF-8431-MSA.

Parameter	Symbol	Min.	Max.	Unit	Conditions
Tx_Disable assert time	t_off		100	μs	Rising edge of Tx_Disable to fall of output signal below 10% of nominal
Tx_Disable negate time	t_on		2	ms	Falling edge of Tx_Disable to rise of output signal above 90% of nominal. This only applies in normal operation, not during start up or fault recovery.
Time to initialize 2-wire Interface	t_2w_start_up		300	ms	From power on or hot plug after the supply meeting SFF8431
Time to initialize	t_start_up		300	ms	From power supplies meeting SFF8431 or hot plug or Tx disable negated during power up, or Tx_Fault recovery, until non-cooled power level I part (or non-cooled power level II part already enabled at power level II for Tx_Fault recovery) is fully operational.
Time to initialize cooled module and time to power up a cooled module to Power Level II	t_start_up_cooled		90	s	From power supplies meeting SFF8431 or hot plug, or Tx disable negated during power up or Tx_Fault recovery, until cooled power level I part (or cooled power level II part during fault recovery) is fully operational. Also, from stop bit low-to-high SDA transition enabling Power Level II until cooled module is fully operational
Time to Power Up to Level II	t_power_level2		300	ms	From stop bit low-to-high SDA transition enabling power level II until non-cooled module is fully operational
Time to Power Down from Level II	t_power_down		300	ms	From stop bit low-to-high SDA transition disabling power level II until module is within power level I requirements
Tx_Fault assert	Tx_Fault_on		1	ms	From occurrence of fault to assertion of Tx_Fault
Tx_Fault assert for cooled module	Tx_Fault_on_cooled		50	ms	From occurrence of fault to assertion of Tx_Fault
Tx_Fault Reset	t_reset	10		μs	Time Tx_Disable must be held high to reset Tx_Fault
RS0, RS1 rate select timing for FC	t_RS0_FC, t_RS1_FC		500	μs	From assertion till stable output
RS0, RS1 rate select timing non FC	t_RS0, t_RS1		24	ms	From assertion till stable output
Rx_LOS assert delay	t_los_on		100	μs	From occurrence of loss of signal to assertion of Rx_LOS
Rx_LOS negate delay	t_los_off		100	μs	From occurrence of presence of signal to negation of Rx_LOS

Dimensions



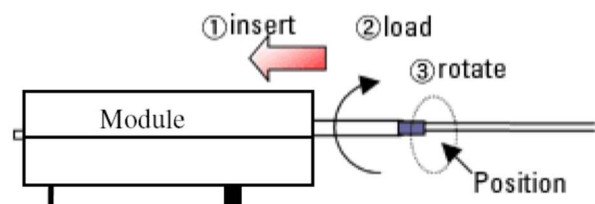
Optical Receptacle Cleaning Recommendations :

All fiber stubs inside the receptacle portions were cleaned before shipment. In the event of contamination of the optical ports, the recommended cleaning process is the use of forced nitrogen. If contamination is thought to have remained, the optical ports can be cleaned using a NTT international Cletop® stick type and HFE7100 cleaning fluid. Before the mating of patch-cord, the fiber end should be cleaned up by using Cletop® cleaning cassette.

Cleaning of patch-cord



Cleaning of fiber stub



1. Insert
Ensure that stick is held straight when inserting into sleeve.
2. Load
Apply sufficient pressure (approx 600-700g) to ensure ferrule a little depressed in sleeve.
3. Rotate
Rotate stick clockwise 4-5 times, while ensuring direct contact with ferrule end-face is maintained.

*Notice: Number of possible wipes:
Maintenance (repair) ~1 use / piece
Equipment construction: 4 uses / piece (max.)*

Note: The pictures were extracted from NTT-ME website. And the Cletop® is a trademark registered by NTT-ME

Ordering Information

Model Number	Part Number	Power Budget	Voltage	Temperature
SFP28-CWDM-08-yy	OPAX-C08-yy-CB	8dB	3.3V	0°C to 70°C
SFP28-CWDM-08-yy	OPAX-C08-yy-IB	8dB	3.3V	-40°C to 85°C

Note: yy=27, Center Wavelength=1270nm , yy=29, Center Wavelength=1291nm
yy=31, Center Wavelength=1311nm , yy=33, Center Wavelength=1331nm

Modification History

Revision	Date	Description
A1	Jul. 2024	Initial Release

Note: All information contained in this document is subject to change without notice.