

25Gb/s SFP28 LWDM 10km industrial temperature Optical Transceiver

DO-RYxxL-V00

Product Specification

Features

- Up to 25.78125Gb/s data links
- LWDM Laser transmitter, PIN photo-detector
- Duplex LC Connector
- 25G electrical interface (25GAUI/CEI-28G-VSR)
- 2-wire interface for management specifications compliant with SFF-8472 digital diagnostic monitoring interface for optical transceivers
- Operating case temperature: -40 to 85°C
- Up to 10km reach via G.652 SMF
- Maximum power consumption 1.8W
- Advanced firmware allowing customer system encryption information to be stored in transceiver
- RoHS compliant



Module picture shown above is that of our standard part and is

Applications

- High-speed storage area networks
- Computer cluster cross-connect
- 25GE Ethernet
- eCPRI and CPRI

Part Number Ordering Information

DO-RYxxL-V00	SFP28 LR LWDM 10km industrial temperature(-40C~85C) optical transceiver with full real-time digital diagnostic monitoring and bail latch
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Where "xx" denotes the central wavelength of optical module. Refer to the following table.

Wavelength Code	Part Number	Center Wavelength(nm)	Wavelength Range Min(nm)	Wavelength Range Max(nm)	Center Frequency (THZ)
57	Do-RY57L-V00	1269.23	1268.24	1270.22	236.2
58	Do-RY58L-V00	1273.54	1272.55	1274.54	235.4
59	Do-RY59L-V00	1277.89	1276.89	1278.89	234.6
60	Do-RY60L-V00	1282.26	1281.25	1283.27	233.8
61	Do-RY61L-V00	1286.66	1285.65	1287.68	233.0
62	Do-RY62L-V00	1291.10	1290.07	1292.12	232.2
63	Do-RY63L-V00	1295.56	1294.53	1296.59	231.4
64	Do-RY64L-V00	1300.05	1299.02	1301.09	230.6
65	Do-RY65L-V00	1304.58	1303.54	1305.63	229.8
66	Do-RY66L-V00	1309.14	1308.09	1310.19	229.0
67	Do-RY67L-V00	1313.73	1312.67	1314.79	228.2
68	Do-RY68L-V00	1318.35	1317.28	1319.42	227.4

1. General Description

This 25Gb/s SFP28 LR LWDM transceiver is designed to transmit and receive optical data over single mode optical fiber.

The module optical connection is duplex LC and shall be compatible with 25G SFP28 pluggable and backward compatible with legacy 10G SFP+ pluggable. The SFP28 LR LWDM module is a dual directional device with a transmitter and receiver plus a control management interface (2-wire interface) in the same physical package. 2-wire interface is used for serial ID, digital diagnostics and module control function.

The module operates by a single +3.3V power supply. The SFP28 LR LWDM module electrical interface is compliant to 25GAUI/CEI-VSR-28G-VSR. It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference. The module offers very high functionality and feature integration, accessible via a two-wire serial interface.

2. Functional Description

The transmitter converts 25Gb/s serial PECL or CML electrical data into serial optical data compliant with the 25GBASE-LR standard. 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 k Ω . 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 25Gb/s serial optical data into serial PECL/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.

3. Transceiver Block Diagram

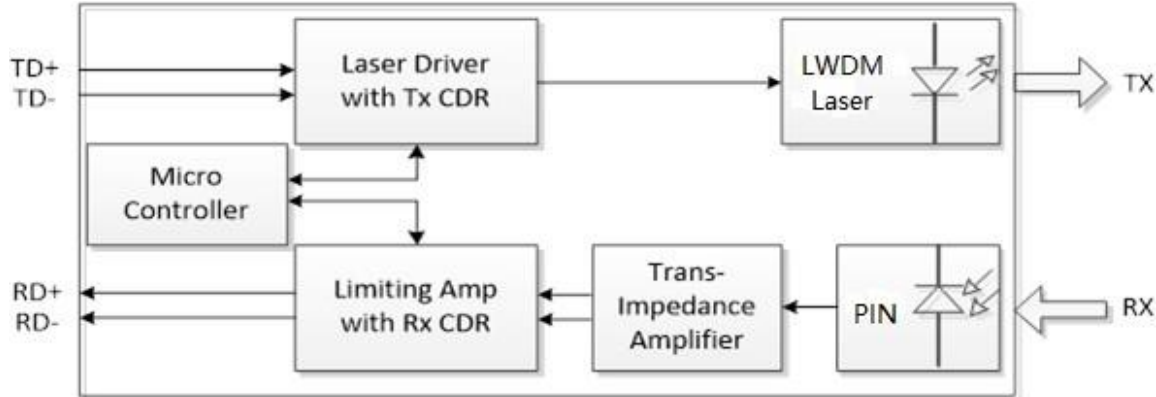


Figure 1. Transceiver Block Diagram

4. Pin Definition

The SFP28 LR LWDM modules are hot-pluggable. Hot pluggable refers to plugging in or unplugging a module while the host board is powered. Its connector and cage shall be compatible with 25G SFP28 pluggable (SFP28, SFF-8402) and backward compatible with legacy 10G SFP+ 10Gb/s (SFF-8083) pluggable, or stacked connector with equivalent electrical performance. Host PCB contact assignment is shown in Figure 2 and contact definitions are given in the PIN description table. SFP28 module contacts mate with the host in the order of ground, power, followed by signal as illustrated by Figure 3 and the contact sequence order listed in the PIN description table.

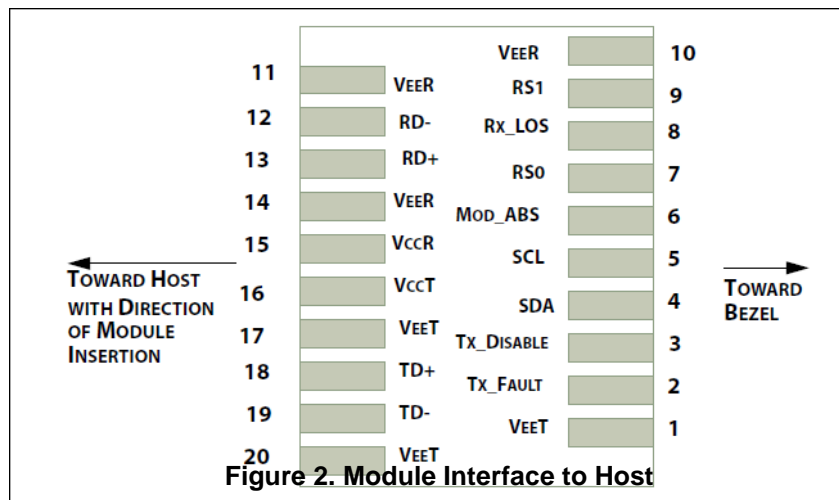


Figure 2. Module Interface to Host

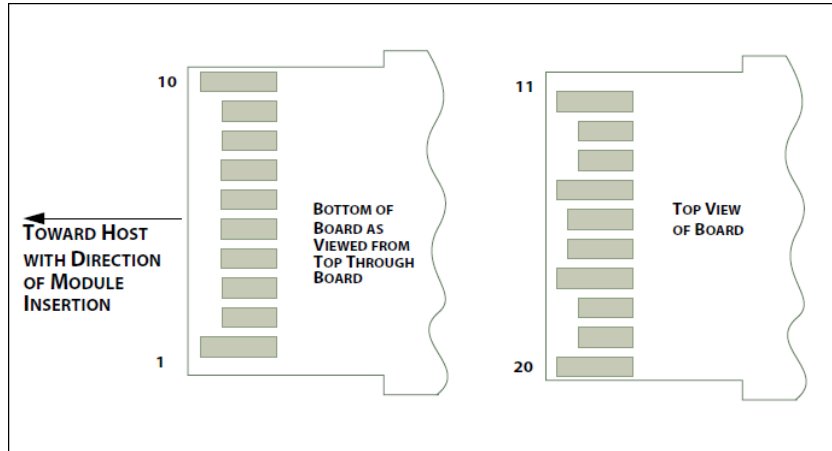


Figure 3. Module Contact Assignment

PIN description

PIN	Logic	Symbol	Name / Description	Notes
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_ABS	Module Absent, connected to VeeT or VeeR 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	
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

Notes:

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.

5. Absolute Maximum Ratings

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

Parameters	Symbol	Min.	Max.	Unit
Power Supply Voltage	VCC	0	3.6	V
Storage Temperature	Tc	-40	85	°C
Operating Case Temperature	Tc	-40	85	°C
Relative Humidity	RH	0	85	%
Damage Threshold	Pmin	7	-	dBm

6. Recommended Operating Environment

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

Parameter	Symbol	Min	Typical	Max	Units	Notes
Operating Case Temperature	Tc	-40		85	°C	
Power Supply Voltage	Vcc	3.135	3.3	3.465	V	
Data Rate		9.8304	24.3	25.78125	Gb/s	1
Data Rate Operating Range		-100		100	ppm	
Control Input Voltage High		2		Vcc	V	
Control Input Voltage Low		0		0.8	V	

Link Distance with G.652	D	0.002		10	km	
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Note:

1. The TX/RX Rate select PINs used for 10G and 25G working mode selecting. Refer to the following table

Hardware Pin Status		Software Control Input		Working Mode
RS0 (PIN7)	RS1 (PIN9)	A2h Byte 110 Bit3 (RS0)	A2h Byte 118 Bit3(RS1)	
L	L	0	0	Working at 10G mode, support data rate of 9.8304Gbps, 10.1376Gbps,10.3125Gbps.
L	L	1	1	Working at 25G mode, support data rate of 24.33024Gbps and 25.78125Gbps.
H	H	0	0	Working at 25G mode, support data rate of 24.33024Gbps and 25.78125Gbps.

7. Electrical Characteristics

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

Parameter	Test Point	Min	Typical	Max	Units	Notes
Power Consumption				1.8	W	
Supply Current	Icc			545	mA	
Transmitter						
Overload Differential Voltage pk-pk	TP1a	900			mV	
Common Mode Voltage (Vcm)	TP1	-350		2850	mV	1
Differential Termination Resistance Mismatch	TP1			10	%	At 1MHz
Differential Return Loss (SDD11)	TP1			See CEI-28G-VSR Equation	dB	

				13-19		
Common Mode to Differential Conversion and Differential to Common Mode Conversion (SDC11, SCD11)	TP1			See CEI-28G-VSR Equation 13-20	dB	
Stressed Input Test	TP1a	See CEI-28G-VSR Section 13.3.11.2.1				
Receiver						
Differential Voltage, pk-pk	TP4			900	mV	
Common Mode Voltage (Vcm)	TP4	-350		2850	mV	1
Common Mode Noise, RMS	TP4			17.5	mV	
Differential Termination Resistance Mismatch	TP4			10	%	At 1MHz
Differential Return Loss (SDD22)	TP4			See CEI-28G-VSR Equation 13-19	dB	
Common Mode to Differential Conversion and Differential to Common Mode Conversion (SDC22, SCD22)	TP4			See CEI-28G-VSR Equation 13-21	dB	
Common Mode Return Loss (SCC22)	TP4			-2	dB	2
Transition Time, 20 to 80%	TP4	12			ps	
Vertical Eye Closure (VEC)	TP4			5	dB	
Eye Width at 10 ⁻¹⁵ probability (EW15)	TP4	0.57			UI	
Eye Height at 10 ⁻¹⁵ probability (EH15)	TP4	228			mV	

Notes:

2. Vcm is generated by the host. Specification includes effects of ground offset voltage.
3. From 250MHz to 30GHz.

8. Optical Characteristics

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

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
Transmitter						
Center Wavelength	λ_t		Ref order information wavelength table		nm	
Center Wavelength Stability	$\Delta\lambda_D$	Refer to the table of part number			nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Spectral Width	SW			1	nm	
Average Optical Power	Pavg	1		7	dBm	1
Laser Off Power	Poff			-30	dBm	
Optical Modulation Amplitude	OMA	1			dBm	2
Transmitter and dispersion penalty (TDP)	TDP			2.7	dB	
Launch power in OMA minus TDP	OMA-TDP	-1			dBm	
Extinction Ratio	ER	4			dB	
Transmitter Optical Eye Mask	{X1, X2, X3, Y1, Y2, Y3}	{0.31, 0.4, 0.45, 0.34, 0.38, 0.4}				3
Optical Return Loss	OTL			20	dB	

Tolerance						
Transmitter Reflectance	T_R			-26	dB	
Relative Intensity Noise	$RIN_{20\text{OMA}}$			-130	dB/Hz	
Receiver						
Center Wavelength	λ_r	1260		1340	nm	
Damage Threshold	TH_d	7			dBm	4
Average Receive Power		-15.3		3		5
Saturation Power	SR	3				
Unstressed Receiver Sensitivity (OMA)	Sens			-14	dBm	6
LOS Assert	LOSA	-30			dBm	
LOS De-assert	LOSD			-19	dBm	
LOS Hysteresis	LOSH	0.5			dB	
Receiver Reflectance	R_R			-26	dB	
Stressed Receiver Sensitivity (OMA)	SRS			-11.5	dBm	7

Notes:

1. Average optical power shall be measured using the methods specified in TIA/EIA-455-95.
2. Even if the TDP < 1 dB, the OMA (min) must exceed this value.
3. Hit ratio 5×10^{-5} hits per sample.
4. The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level.
5. Average receive power (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
6. Receiver sensitivity (OMA), (max) is informative. The bit error ratio (BER) shall be less than 5×10^{-5} .

7. 25G mode, measured with 24.33024G、25.78125G, PRBS-31 NRZ, ER>4dB, 1260~1340nm, BER<5E-5.

10G mode, measured with 9.8304G、10.1376G、10.3125G、PRBS-31 NRZ, ER>4 dB, 1260~1340nm, BER<1E-12.

9. Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF8472 Rev12 with internal calibration mode.

Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temp
Laser power monitor absolute error	DMI_TX	-2	2	dB	1
RX power monitor absolute error	DMI_RX	-2	2	dB	1
Supply voltage monitor absolute error	DMI_VCC	-0.1	0.1	V	Full operating range
Bias current monitor	DMI_Ibias	-10%	10%	mA	

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.

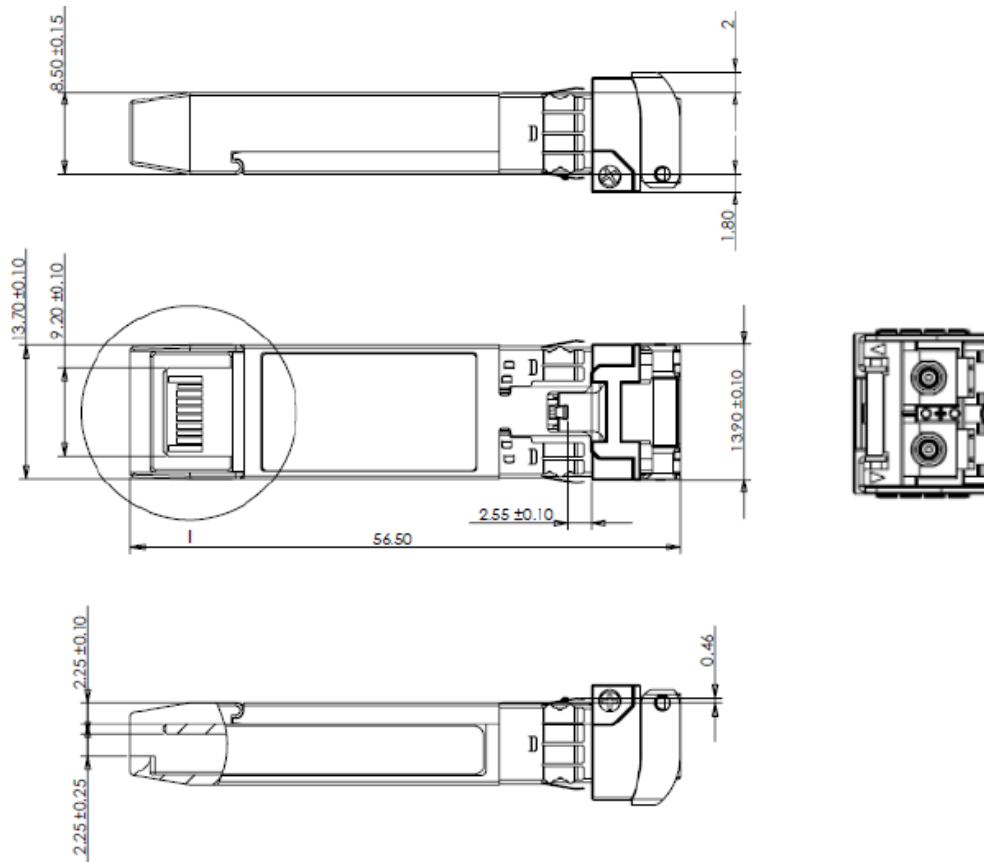
10. Control and Status I/O Timing Characteristics

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

<i>Parameter</i>	<i>Symbol</i>	<i>Min.</i>	<i>Max.</i>	<i>Unit</i>	<i>Conditions</i>
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

11. Mechanical Dimensions

Comply with SFF-8432 rev. 5.0, the improved Pluggable form factor specification.



12. ESD

This transceiver is specified as ESD threshold 1kV for SFI pins 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.

13. 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.

