

25Gb/s LR 10km SFP28 Transceiver

HD-SFP28/25G-LR

1 Features

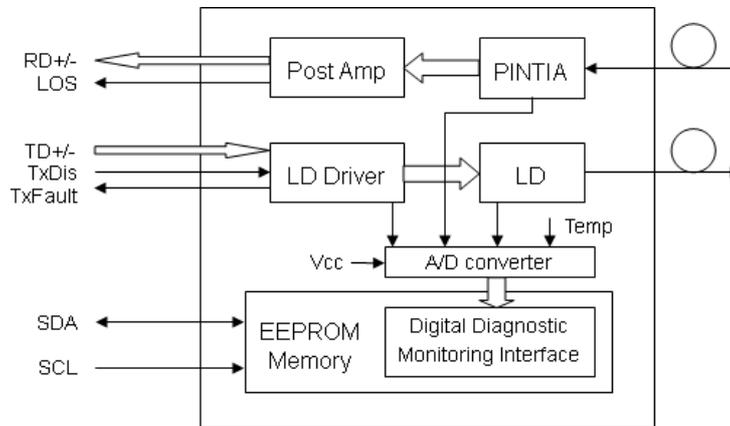
- Duplex LC connector Support up to 28Gb/s bit rates
- Compliant with SFP28 MSA
- Electrical interface compliant to SFF-8431
- Hot-pluggable SFP footprint
- Built-in digital diagnostic functions
- Up to 10 km on 9/125um SMF G.652
- Single power supply 3.3V
- RoHS6/6 compliant
- Class 1 laser product complies with EN 60825-1
- Operating temperature range: 0°C to 70°C/-40°C to 85°C
- Power consumption <1.2W

2 Applications

25GBASE-LR

3 General

The SFP28 LR module is compliant with SFF-8431. It offers previously unavailable system cost, upgrade, and reliability benefits by virtue of being hot-pluggable.



4 Performance Specifications

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	
Storage Temperature	T _{stg}	-40	+85	°C	
Operating relative humidity (Non- condensing)	RH	5	95	%	
Case Temperature (Operating)	T _c	CCBL	0	+70	°C
		CCVL	-40	+85	
Input Voltage	-	GND	V _{cc}	V	

Power Supply Voltage	$V_{cc}-V_{ee}$	-0.5	+3.6	V
Receiver Optical Input Power			3	dBm

Recommended Operating Environment

Parameter	Symbol	Min.	Typ.	Max.	Unit	
Power Supply Voltage	V_{cc}	+3.135	+3.3	+3.465	V	
Power Supply Current @ 3.3V	I_{cc}	-	-	350	mA	
Operating relative humidity (Non- condensing)	RH	5		85	%	
Case Temperature (Operating)	T_c	CCBL	0	-	+70	°C
		CCVL	-40	-	+85	
Data Rate	-	-	-	28	Gb/s	
I2C clock frequency		-	100	400	KHz	
Power consumption Max	-	-	-	1.5	W	

Transmitter E-O Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Support data rate	-	-	-	28	Gb/s	-
Peak Wavelength	λ_p	1295	1310	1325	nm	4
Spectral Width (-20dB)	$\Delta\lambda$	-	-	1	nm	-
Side Mode Suppression Ratio	SMSR	30			dB	
Average Optical Output Power	P_o	-5	-	2	dBm	
Extinction Ratio	E_r	3.5	-	-	dB	
Transmitter and dispersion penalty	TDP			3	dB	
Output Power with Transmitter Disabled	P_{off}			-30	dBm	
Transmitter Enable Voltage	VEN	-0.3	-	0.8	V	
Transmitter Disable Voltage	VD	2.0	-	$V_{cc}+0.3$	V	
Differential Data Input Swing	V_{INPP}	180	-	700	mV	
Optical return loss tolerance				-12	dB	
Output Eye Diagram	Compliant with IEEE 802.3					1

Receiver O-E Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Support data rate	-	-	-	28	Gb/s	-
Operate Wavelength	-	1260	-	1360	nm	-
Receiver sensitivity in OMA	S_{en}	-	-	-12	dBm	2
Receiver sensitivity(BER of 1E-12)	S_{en}	-	-	-8.6	dBm	
Saturation(BER of 1E-12)	P_{sat}	2	-	-	dBm	2
LOS Asserted	T_{loss_on}	-30	-	-	dBm	High level: Alarm
LOS De-Asserted	T_{loss_off}	-	-	-13	dBm	
LOS Hysteresis	T_{loss_Hs}	0.5	-	5.0	dB	
Differential Data Output Swing	V_{OUTPP}	450	-	1050	mV	-

LOS Low Voltage	VLout	-	-	0.4	V	-
LOS High Voltage	VHout	2.0	-	-	V	-

Notes:

- 1 At least 1000 waveforms acquired, with minimum 5% margin against 802.3 mask
- 2 Receiver sensitivity is measured with conformance test signal for BER=5x10⁻⁵.

Digital Diagnostic Monitoring Characteristics

Parameter	Symbol	Range	Accuracy
Transceiver Case Temperature	T	Measured transceiver case temperature over specified operating range	±3°C
Supply Voltage	Vcc	Internally measured transceiver supply voltage ,3.0~3.6V	±3%
TX Bias Current	Id	Measured TX Bias current in uA	±10%
TX Output Power	Po	Measured TX Output Power in dBm Over the specified output power range	±3dB
Received Optical Power	Pi	Measured RX Received Power in dBm Over the specified input power range, 0~-10.4dBm,	±3dB

I/O Timing Requirement

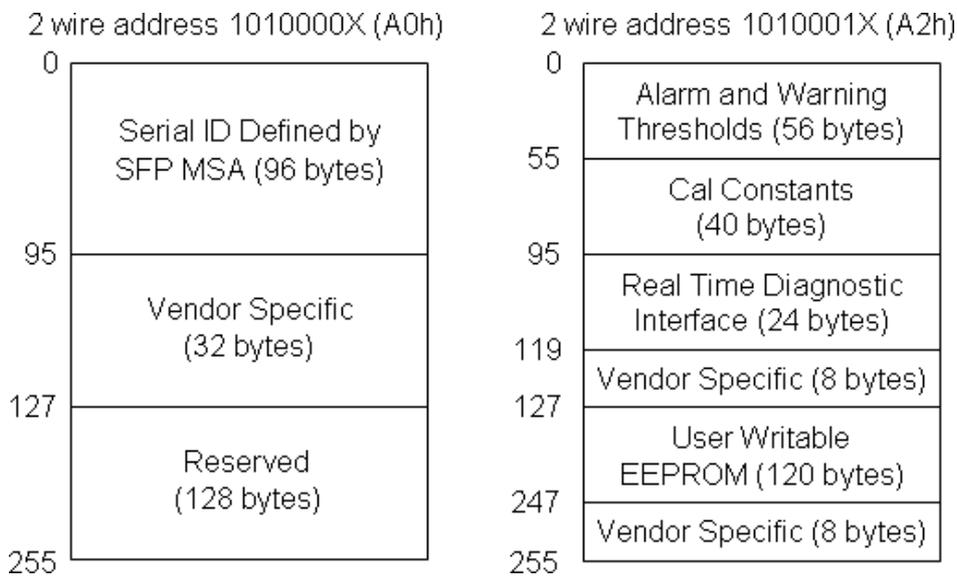
Timing Requirements of Control and Status I/O					
Parameter	Symbol	Min	Max	Unit	Conditions
TX Disable Assert Time	t_off		100	µs	Rising edge of Tx_Disable to fall of output signal below 10% of nominal
TX Disable Negate Time	t_on		2	ms	Falling edge of Tx_Disable to rise of output signal above 90%of nominal. This only applies in normal operation, not during start up or fault recovery.
Time to initialize	t_init		300	ms	From power on or hot plug after the supply meeting
Time to initialize	t_start_up		300	ms	From power supplies meeting Table8 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.
TX Fault Reset	t_reset	10		us	Time Tx_Disable must be held high to reset Tx_Fault
TX Fault Assert	Tx_fault_on		1	ms	From occurrence of fault to assertion of Tx_Fault
LOS Assert Time	t_loss_on		100	µs	From occurrence of loss of signal

					to assertion of Rx_LOS
LOS Deassert Time	t_loss_off		100	μs	From occurrence of presence of signal to negation of Rx_LOS

5 EEPROM Section

The optical transceiver contains an EEPROM. It provides access to sophisticated identification information that describes the transceiver’s capabilities, standard interfaces, manufacturer, and other information.

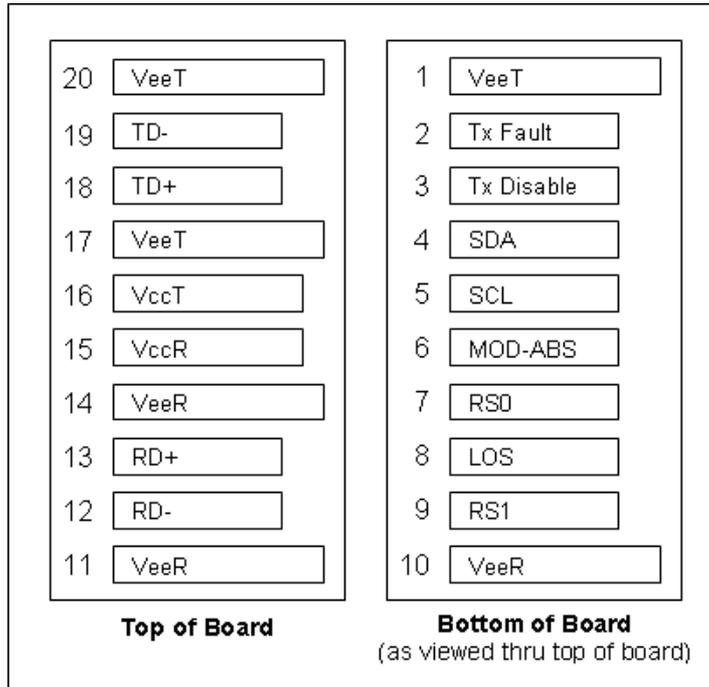
The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. The diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 - 95 at wire serial bus address A2h. The digital diagnostic memory map specific data field defines as following.



Memory Map

6 Pin Definitions

Pin Diagram



Pin Descriptions

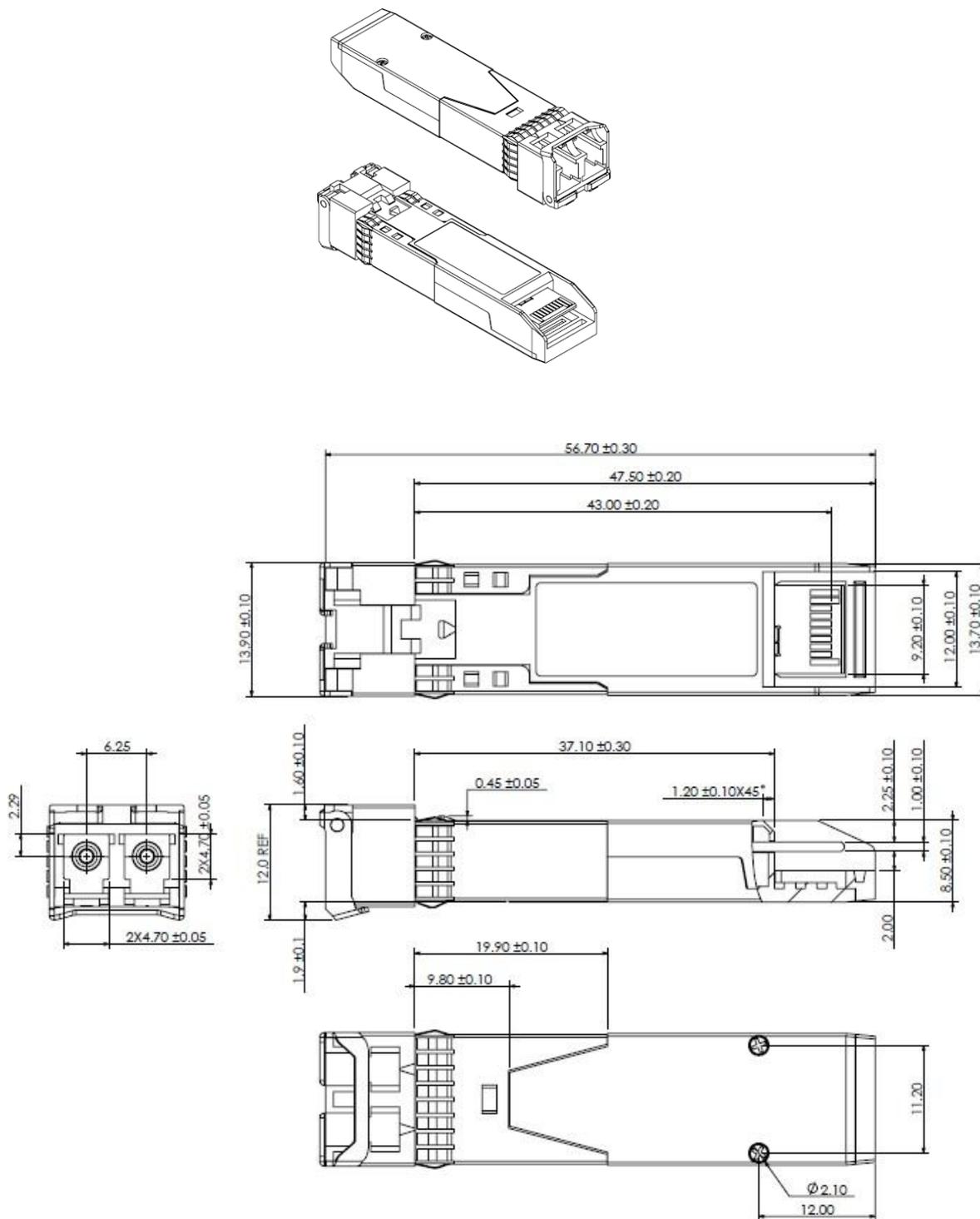
Pin#	Logic	Name	Function	Notes
1		VeeT	Transmitter Ground	-
2	LVTTL-O	TX Fault	Transmitter Fault Indication	Note 1
3	LVTTL-I	TX Disable	Transmitter Disable	Note 2, Module disables on high or open
4	LVTTL-I	SDA	2-wire Serial Interface Data Line (Same as MOD-DEF2 in INF-8074i)	
5	LVTTL-I/O	SCL	2 Wire Serial Interface Data Line (Same as MOD-DEF1 as defined in the INF-8074i)	
6		MOD-ABS	Module Absent, Connected to VeeT or VeeR in the module.	Note 3
7	LVTTL-I	RS0	SFP+ RX Rate Select, optional	Rate Select 0, Not used. Note 9
8	LVTTL-O	LOS	Loss of Signal	Note 4
9	LVTTL-I	RS1	SFP+ TX Rate Select, optional	Rate Select 1, Not used. Note 9
10		VeeR	Receiver Ground	Note 5
11		VeeR	Receiver Ground	Note 5
12	CML-O	RD-	Inv. Received Data Out	Note 6
13	CML-O	RD+	Received Data Out	Note 6
14		VeeR	Receiver Ground	Note 5
15		VccR	Receiver Power	Note 7, 3.3V± 5%

Pin#	Logic	Name	Function	Notes
16		VccT	Transmitter Power	Note 7, 3.3V± 5%
17		VeeT	Transmitter Ground	Note 5
18	CML-I	TD+	Transmit Data In	Note 8
19	CML-I	TD-	Inv. Transmit Data In	Note 8
20		VeeT	Transmitter Ground	Note 5

Notes:

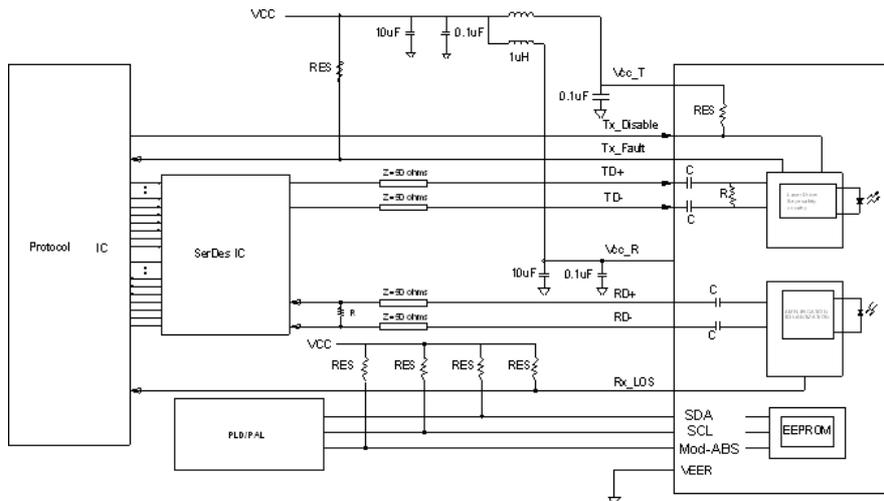
- TX Fault is an open collector/drain output, which should be pulled up with a 4.7K–10K Ω resistor on the host board. Pull up voltage between 2.0V and VccT +0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.4V.
- TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7–10 K Ω resistor. Its states are:
 Low (-0.3 – 0.8V): Transmitter on
 (>0.8, < 2.0V): Undefined
 High (2.0 –VccT+0.3V): Transmitter Disabled
 Open: Transmitter Disabled
- Mod-ABS shall be pulled up with a 4.7K – 10K Ω resistor on the host board. The pull-up voltage shall be VccT or VccR.
- LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10K Ω resistor. Pull up voltage between 2.0V and VccR+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.4V.
- VeeR and VeeT may be internally connected within the SFP module.
- RD-/+ : These are the differential receiver outputs. They are AC coupled 100 Ω differential lines which should be terminated with 100 Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.
- VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP connector pin. Maximum supply current is 300mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 Ω 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. VccR and VccT may be internally connected within the SFP transceiver module.
- TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.
- Internally pulled down per SFF-8431 Rev 4.1.

7 Outline Dimensions



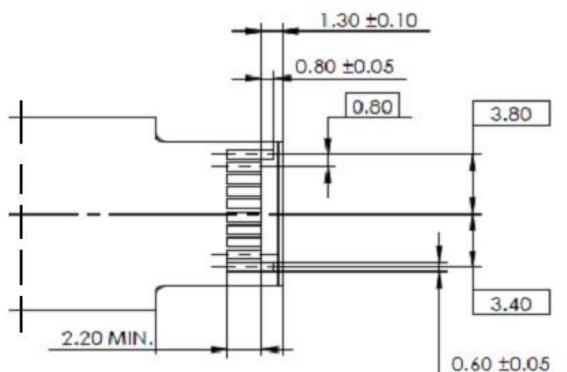
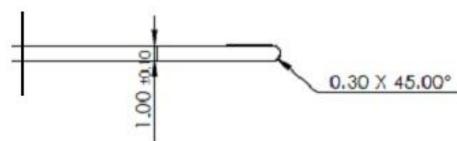
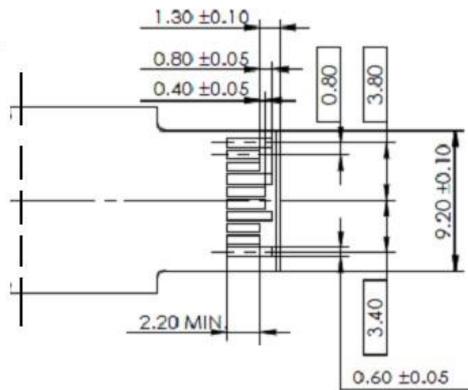
(Unit: mm)

8 Recommended Circuit



NOTE: 4.7K ohms < RES < 10K ohms

9 Pattern Layout of SFP Printed Circuit Board



(Unit: mm)

10 Ordering Information

Part number	Product Description
HD-SFP28/25G-LR	25Gb/s 10km LR SFP28 Transceiver, LC, 10km, 0°C~+70°C With DDM
HD-SFP28/25G-LR-I	25Gb/s 10km LR SFP28 Transceiver, LC, 10km, -40°C~+85°C With DDM