

## Features:

- ☞ Operating data rate up to 25Gbps
- ☞ LAN-WDM EML Cooling laser and APD receiver
- ☞ Hot-pluggable SFP28 footprint
- ☞ Built-in digital diagnostic functions
- ☞ Single +3.3V power supply
- ☞ Power dissipation less than 2.0 W
- ☞ Internal CDR on both transmitter and receiver channel
- ☞ Support CDR bypass
- ☞ SFP28 MSA package with receptacle LC connector
- ☞ Very low jitter
- ☞ Very low EMI and excellent ESD protection
- ☞ RoHS compliant

## Applications:

- ☞ 25GBASE-LR 25G Ethernet
- ☞ 25.78125 Gb/s LAN-WDM
- ☞ CPRI/eCPRI
- ☞ Other optical link

## Specification:

### ● Electrical and Optical Characteristics: (Condition: $T_a=T_{OP}$ )

Parameter	Symbol	Min.	Typical	Max.	Unit
Transmitter Differential Input Voltage	+/-TX_DAT	200		2400	mV p-p
Supply Current	I <sub>CC</sub>		150	300	mA
Tx_Disable Input Voltage – Low	V <sub>IL</sub>	0		0.8	V
Tx_Disable Input Voltage – High	V <sub>IH</sub>	2.0		V <sub>CC</sub>	V
Tx_Fault Output Voltage – Low	V <sub>OL</sub>	0		0.8	V
Tx_Fault Output Voltage – High	V <sub>OH</sub>	2.0		V <sub>CC</sub>	V
Receiver Differential Output Voltage	+/-RX_DAT	600		1400	mV p-p
Rx_LOS Output Voltage- Low	V <sub>OL</sub>	0		0.8	V
Rx_LOS Output Voltage- High	V <sub>OH</sub>	2.0		V <sub>CC</sub>	V

● **Characteristics of Transmitter**

Parameter	Symbol	Min	Typ	Max	Unit
Bit rate	B	-100ppm	25.78125	+100ppm	Gb/s
Center Wavelength LAN WDM 12 $\lambda$	$\lambda_c$	1268.24	1269.23	1270.22	nm
		1272.55	1273.54	1274.54	
		1276.89	1277.89	1278.89	
		1281.25	1282.26	1283.27	
		1285.65	1286.66	1287.68	
		1290.07	1291.11	1292.12	
		1294.53	1295.56	1296.59	
		1299.02	1300.05	1301.09	
		1303.54	1304.58	1305.63	
		1308.09	1309.14	1310.19	
		1312.67	1313.73	1314.79	
		1331.32	1332.41	1333.5	
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Spectral Width@-20dB	$\Delta\lambda$	-	-	1	nm
Average Launch Power	Po	+2.5	-	+6	dBm
Average Launch Power of Off TX	Poff	-	-	-35	dBm
Extinction Ratio	Phi/Plo	6	-	-	dB
Relative Intensity Noise	RIN	-	-	-130	dB/Hz
Optical Return Loss Tolerance	ORL	-	-	20	dB
Transmitter Reflectance	RT	-	-	-12	dB
Dispersion Penalty	DP	-	-	1.5	dB
Transmitter Output Eye	Compliant with IEEE802.3by standard				

● **Characteristics of Receiver**

Parameter	Symbol	Min	Typ	Max	Unit
Wavelength	$\lambda$	1268.24	-	1333.5	dBm
Average Rx Sensitivity (Note1)	Pmin	-	-	-19.5	dBm
Maximum Input Power(Note1)	Pmax	-	-	-5	dBm
LOS Assert (Note1)	LOSA	-35	-	-	dBm
LOS De-Assert (Note1)	LOSD	-	-	-23	dBm
Hysteresis	SDHys	0.5		5	dB

Receiver Reflectance	RR	-	-	-26	dB
Optical Return Loss	ORL	12	-	-	dB
Total Link budget	TLB	19	-	-	dB

(Note1) Receiving signals is 25.78125Gbps, PRBS 2<sup>31</sup>-1, BER=5x10<sup>-5</sup>, ER=6dB, Tx=ON

● **Absolute Maximum Ratings: (T<sub>C</sub>=25°C)**

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T <sub>ST</sub>	-40	+85	°C
Operating Temperature	T <sub>IP</sub>	0(-40)	+70(+85)	°C
Input Voltage	T <sub>CC</sub>	0	+5	V

● **Recommended Operating Environment:**

Parameter	Symbol	Min.	Typical	Max.	Unit
Supply Voltage	V <sub>CC</sub>	+3.0	+3.3	+3.6	V
Operating Temperature	T <sub>OP</sub>	0	-	+70	°C

● **Timing Characteristics:**

Parameter	Symbol	Min.	Typical	Max.	Unit
TX_DISABLE Assert Time	t <sub>off</sub>		3	10	usec
TX_DISABLE Negate Time	t <sub>on</sub>		0.5	1	msec
Time to Initialize Include Reset of TX_FAULT	t <sub>int</sub>		30	300	msec
TX_FAULT from Fault to Assertion	t <sub>fault</sub>		20	100	usec
TX_DISBEL Time to Start Reset	t <sub>reset</sub>	10			usec
Receiver Loss of Signal Assert Time (Off to On)	T <sub>A,RX_LOS</sub>			100	usec
Receiver Loss of Signal Assert Time (On to Off)	T <sub>d,RX_LOS</sub>			100	usec

● **Serial ID Memory Contents:**

Data Address	Length (Byte)	Name of Length	Description and Contents
Base ID Fields			
0	1	Identifier	Type of Serial transceiver (03h=SFP28)
1	1	Reserved	Extended identifier of type serial transceiver (04h)
2	1	Connector	Code of optical connector type (07=LC)
3-10	8	Transceiver	Gigabit Ethernet 1000Base-SX & Fiber Channel
11	1	Encoding	8B10B (01h)
12	1	BR,Nominal	Nominal baud rate, unit of 100Mbps

13-14	2	Reserved	(0000h)
15	1	Length(9um)	Link length supported for 9/125um fiber, units of 100m
16	1	Length(50um)	Link length supported for 50/125um fiber, units of 10m
17	1	Length(62.5um)	Link length supported for 62.5/125um fiber, units of 10m
18	1	Length(Copper)	Link length supported for copper, units of meters
19	1	Reserved	
20-35	16	Vendor Name	SFP28 vendor name
36	1	Reserved	
37-39	3	Vendor OUI	SFP28 transceiver vendor OUI ID
40-55	16	Vendor PN	Part Number
56-59	4	Vendor rev	Revision level for part number
60-62	3	Reserved	
63	1	CCID	Least significant byte of sum of data in address 0-62
Extended ID Fields			
64-65	2	Option	Indicates which optical SFP28 signals are implemented (001Ah = LOS, TX_FAULT, TX_DISABLE all supported)
66	1	BR, max	Upper bit rate margin, units of %
67	1	BR, min	Lower bit rate margin, units of %
68-83	16	Vendor SN	Serial number (ASCII)
84-91	8	Date code	Manufacturing date code
92-94	3	Reserved	
95	1	CCEX	Check code for the extended ID Fields (addresses 64 to 94)
Vendor Specific ID Fields			
96-127	32	Readable	specific date, read only

## ● Digital Diagnostic Monitoring Functions

2-wire serial bus address 1010001X (A2h) is used to access measurement of transceiver temperature, internally measured supply voltage, TX bias current, TX optical output power and RX optical input power which are shown in table 1. Each diagnostic parameter has a corresponding high alarm, low alarm, high warning and low warning threshold which are shown in table 2.

Table 1. Diagnostic Parameters

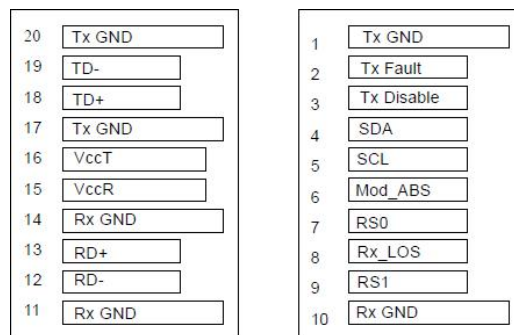
Diagnostic Parameter	Range		LSB	Accuracy	Address	Note
	Min	Max				
Transceiver Temperature (Temp)	-50[°C]	+80[°C]	1/256[°C]	±3[°C]	96-97	A 16bit signed two's complement value
Supply Voltage (Voltage)	+3.0[V]	+3.6[V]	100[μV]	±3[%]	98-99	A 16bit unsigned integer
TX Bias Current (Bias)	3[mA]	95[mA]	2.0[μA]	±10[%]	100-101	A 16bit unsigned integer

TX Optical Output Power (TX Power)	+2.5[dBm]	+6[dBm]	0.1[ $\mu$ W]	$\pm$ 3 [dB]	102-103	A 16bit unsigned integer
RX Optical Input Power (RX Power)	-19.5[dBm]	+0[dBm]	0.1[ $\mu$ W]	$\pm$ 3 [dB]	104-105	A 16bit unsigned integer

Table 2. Alarm and Warning Thresholds

Parameter	Warning		Alarm		Unit
	Low	High	Low	High	
Transceiver Temperature (Temp)	-10	+80	-20	+90	°C
Supply Voltage (Voltage)	+3.13	+3.47	+3.0	+3.6	V
TX Bias Current (Bias)	5	85	3	95	mA
TX Optical Output Power (TX Power)	+2.5	+6	+1.5	+7	dBm
RX Optical Input Power (RX Power)	-18.5	+1	-19.5	+2	dBm

## ● Pin Assignment



**Pin out of Connector Block on Host Board**

● **Pin Description:**

Pin	Symbol	Description	Note	Plug Seq. *
1	VeeT	Module transmitter ground	1	1
2	Tx Fault	Module transmitter fault	2	3
3	Tx Disable	Transmitter Disable; Turns off transmitter laser output	3	3
4	SDL	2 wire serial interface data input/output (SDA)	4	3
5	SCL	2 wire serial interface clock input (SCL)	4	3
6	MOD-ABS	Module Absent, connect to VeeR or VeeT in the module	5	3
7	RS0	Receiver Rate select	-	3
8	LOS	Receiver Loss of Signal Indication	6	3
9	RS1	Transmitter Rate select, Not used for this product	-	3
10	VeeR	Module receiver ground	1	1
11	VeeR	Module receiver ground	1	1
12	RD-	Receiver inverted data out put	-	3
13	RD+	Receiver non-inverted data out put	-	3
14	VeeR	Module receiver ground	1	1
15	VccR	Module receiver 3.3V supply	-	2
16	VccT	Module transmitter 3.3V supply	-	2
17	VeeT	Module transmitter ground	1	1
18	TD+	Transmitter inverted data out put	-	3
19	TD-	Transmitter non-inverted data out put	-	3
20	VeeT	Transmitter ground (Common with receiver ground)	1	1

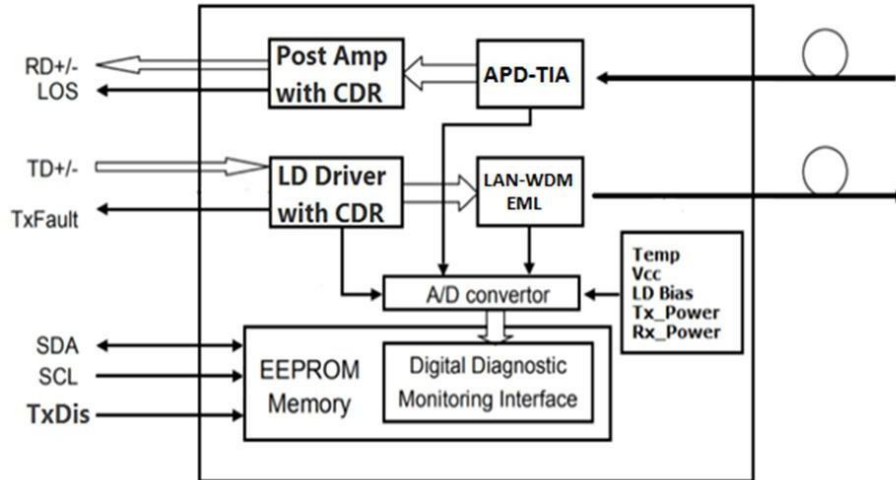
\*Plug Seq.: Pin engagement sequence during hot plugging

Note)

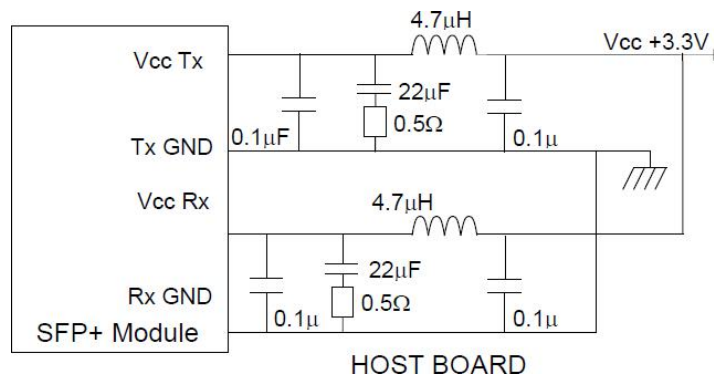
1. The module ground contacts, Tx GND and Rx GND, shall be isolated from the module case, that is, frame ground.
2. Tx Fault is an open collector/drain output that shall be pulled up with a  $4.7k\Omega \sim 10k\Omega$  on the host board. Pull up voltage between 2.0V and  $V_{ccT} + 0.5V$ . When high, output indicates a laser fault of some kind. When low, output indicates normal operation. The LD output is not turned off in case of Tx Fault.
3. Tx Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the TRx with a  $4.7k\Omega \sim 10k\Omega$  to  $V_{ccT}$ .
4. SDA and SCL should be pulled up with a  $4.7k\Omega \sim 10k\Omega$  on the host board. The pull-up voltage shall be  $V_{ccT}$ .  
SCL is the clock line of 2-wire serial interface for serial ID. SDA is the data line of 2-wire serial interface for serial ID.

5. Mod\_ABS is connected to Tx GND or Rx GND in the SFP+ module.  
The host may pull the contact up to Vcc on the host board with a resistor in the range 4.7kΩ ~ 10kΩ.  
Mod\_ABS is asserted “high” when the SFP+ module is physically absent from a host slot. In the SFP MSA (INF-8074i) this contact has the same function but is called MOD\_DEF0.
6. LOS is an open collector output. Shall be pulled up with a 4.7kΩ ~ 10kΩ on host board. Pull up voltage between 2.0 and VccR+0.3. Logic 0 indicates normal operation.

### ● SFP+ Block Diagram

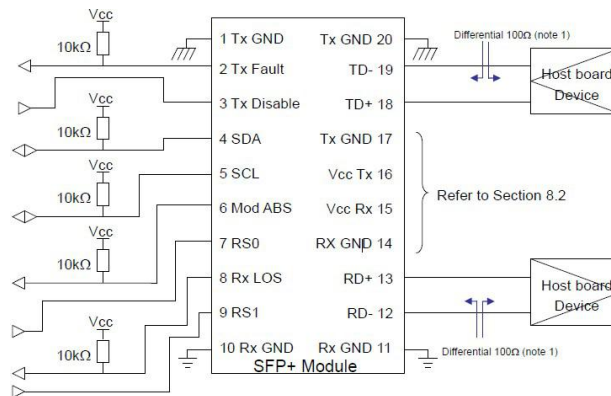


### ● Recommended Host Board Supply Filtering Network





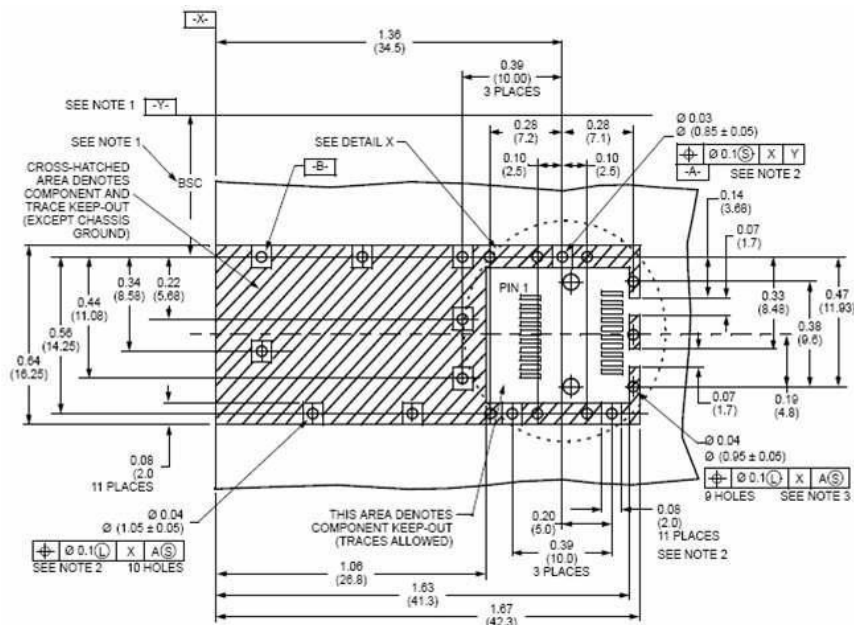
## ● SFP+ Host Board Interface



Note 1: Host board output device circuit in the transmitter side and host board input device circuit in the receiver should be carefully designed to meet 100ohm differential impedance matching. Also necessary is the dc bias circuit of each input and output by taking into account of ac coupling of data input and output of SFP+ module. For the interface of host board devices, it is recommended to refer to the device vendor's data sheet.

## ● PCB layout and Bezel recommendation

Dimensions are in inches (millimeters)

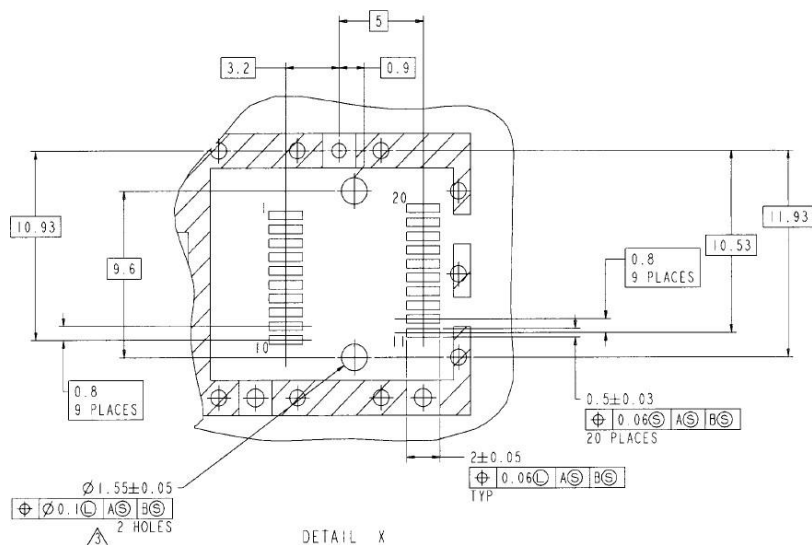


(Note 1) Datum and basic dimensions established by customer. (Note 2) Pads

and vias are chassis ground, 11 locations.

(Note 3) Thru holes, plating optional.





### Ordering information:

Part Number	Package	Rate	Fiber type	Distance	Wavelength (nm)	Temperature (°C)
TM-PEELAN269-443E	SFP28 LAN	25Gbps	SMF	40km	1269.23	0/+70
TM-PEELAN273-443E	SFP28 LAN	25Gbps	SMF	40km	1273.54	0/+70
TM-PEELAN277-443E	SFP28 LAN	25Gbps	SMF	40km	1277.89	0/+70
TM-PEELAN282-443E	SFP28 LAN	25Gbps	SMF	40km	1282.26	0/+70
TM-PEELAN286-443E	SFP28 LAN	25Gbps	SMF	40km	1286.66	0/+70
TM-PEELAN291-443E	SFP28 LAN	25Gbps	SMF	40km	1291.11	0/+70
TM-PEELAN295-443E	SFP28 LAN	25Gbps	SMF	40km	1295.56	0/+70
TM-PEELAN300-443E	SFP28 LAN	25Gbps	SMF	40km	1300.05	0/+70
TM-PEELAN304-443E	SFP28 LAN	25Gbps	SMF	40km	1304.58	0/+70
TM-PEELAN309-443E	SFP28 LAN	25Gbps	SMF	40km	1309.14	0/+70
TM-PEELAN313-443E	SFP28 LAN	25Gbps	SMF	40km	1313.73	0/+70
TM-PEELAN332-443E	SFP28 LAN	25Gbps	SMF	40km	1332.41	0/+70

● **Mechanical Dimensions:**

