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Product Specification
SFP DWDM 1G 120km LC
2.5Gbps Single Mode DWDM SFP Transceiver
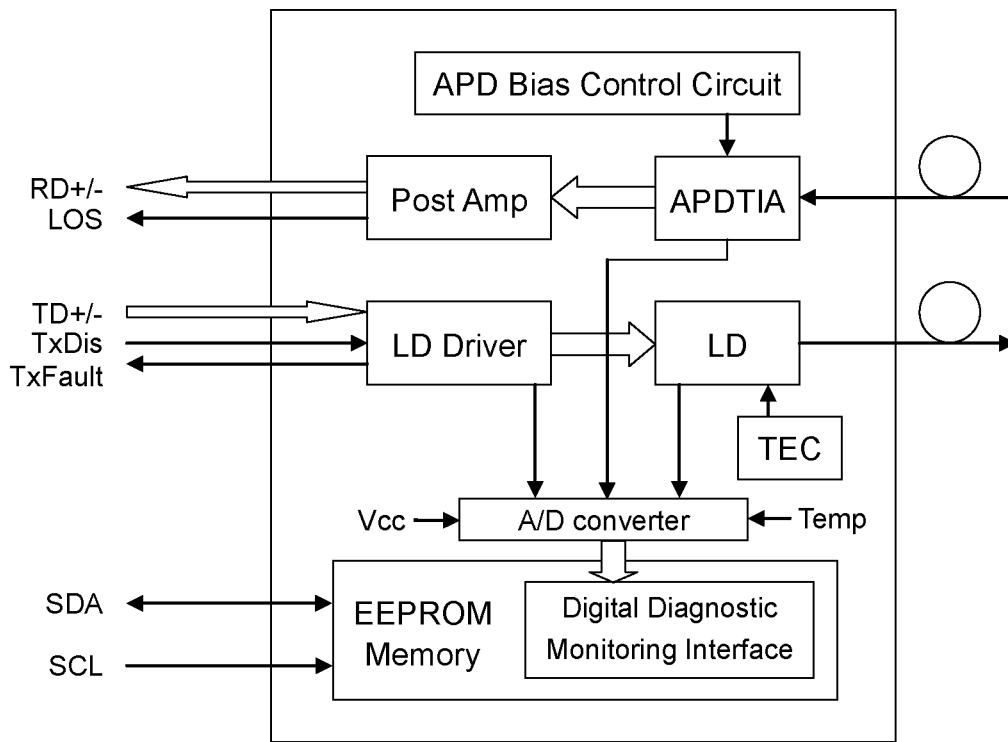

1. Product Features

- Transceiver unit with independent DWDM DFP Laser diode transmitter APD photodiode receiver
- Compliant with DWDM SFP MSA
- Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- Digital diagnostic monitoring
- Internal Calibration of DDM
- Hot-pluggable
- Metal enclosure for lower EMI
- +3.3V Single power supply
- 100GHz ITU Grid, C/L Band
- Wavelength controlled within ± 0.1 nm over life and temperature
- LVPECL logic interface simplifies interface to external circuitry
- LVTTL logic level RX LOS
- With pull de-latch
- 120 km with 9/125 µm single mode fiber (SMF) of maximum interconnect distances

2. Applications

- C Band DWDM networks

3. Description

The optical transceiver is compliant with the Small Form-Factor Pluggable (SFP) Multi-Source Agreement (MSA) and SFF-8472. It offer a simple and convenient way to interface PCBs to single mode fiber optic cables in Dense Wavelength Division Multiplexing (DWDM) applications. It is a high performance, cost effective module for serial optical data communication applications.

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│              ┌──────────────────────────┐                │
│              │  APD Bias Control Circuit │                │
│              └──────────────────────────┘                │
│                            │                      ◯       │
│         ┌──────────┐      ▼     ┌──────────┐              │
│  RD+/- ◄┤ Post Amp ◄─────────── │  APDTIA  ◄────────       │
│  LOS  ◄─┤          │             │          │              │
│         └──────────┘            └──────────┘              │
│                                                            │
│  TD+/-  ┌──────────┐         ┌──────────┐          ◯      │
│  TxDis ─► LD Driver├────────►│    LD    ├────────►         │
│ TxFault◄┤          │         │          │                  │
│         └──────────┘         └──────────┘                  │
│              │       │            │   ┌──────┐             │
│              │       │            │   │ TEC  │             │
│              ▼       ▼            ▼   └──────┘             │
│  Vcc ──►┌──────────────────────────┐◄── Temp              │
│         │      A/D converter       │                       │
│         └──────────────────────────┘                       │
│         ┌──────────┐ ┌──────────────────────┐             │
│ SDA ◄──►│  EEPROM  │ │  Digital Diagnostic  │             │
│         │  Memory  │ │ Monitoring Interface │             │
│ SCL ───►│          │ │                      │             │
│         └──────────┘ └──────────────────────┘             │
└─────────────────────────────────────────────────────────┘
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3.1. Transmitter Section

Transmitter is designed for single mode fiber and operates at DWDM wavelength of C Band. The transmitter module uses a DFB laser diode and full IEC825 and CDRH class 1 eye safety. The output power can be disabled via the single TX Disable pin. Logic LVTTL HIGH level disables the transmitter. It contains APC function, temperature compensation circuit, PECL data inputs, LVTTL TX Disable input and TX Fault output interface.

3.2. Receiver Section

The receiver section uses a hermetic packaged front end receiver (APD and preamplifier). The post amplifier is AC coupled to preamplifier through a capacitor and a low pass filter. The capacitor and LPF are enough to pass the signal from 5Mb/s to 2670Mb/s without significant distortion or performance penalty. The LPF limits the preamplifier bandwidth to improve receiver sensitivity. As the input optical is decreased, LOS will switch from low to high. As the input optical power is increased from very low levels, LOS will switch back from high to low.
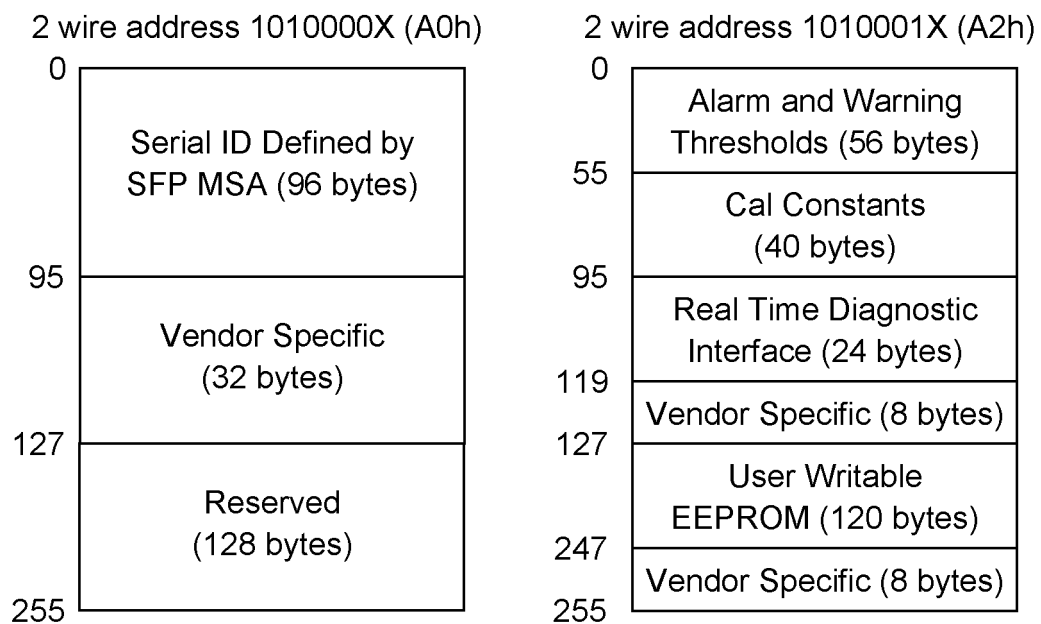
3.3. EEPROM Section

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 serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C01A/02/04 family of components. When the serial protocol is activated, the host

generates the serial clock signal (SCL, Mod Def 1). The positive edge clocks data into those segments of the EEPROM that are not write protected within the SFP transceiver. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

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.

2 wire address 1010000X (A0h)	2 wire address 1010001X (A2h)
0 — Serial ID Defined by SFP MSA (96 bytes)	0 — Alarm and Warning Thresholds (56 bytes)
95 — Vendor Specific (32 bytes)	55 — Cal Constants (40 bytes)
127 — Reserved (128 bytes)	95 — Real Time Diagnostic Interface (24 bytes)
255	119 — Vendor Specific (8 bytes)
	127 — User Writable EEPROM (120 bytes)
	247 — Vendor Specific (8 bytes)
	255

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4. Performance Specifications

4.1. Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature (Non-operating)	Tstg	-40	+85	°C
Case Temperature (Operating)	TC	-15	+70	°c
Input Voltage	-	GND	Vcc	V
Power Supply Voltage	Vcc-Vee	-0.5	+3.6	V

4.2. Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit
Power Supply Voltage	Vcc	+3.14	+3.3	+3.47	V
Power Supply Current	Icc	-	-	500	mA [1]
Case Temperature (Operating)	TC	-15	-	+70	°C
Data Rate	-	-	2.5	-	Gb/s

Notes:
[1]   The current excludes the output load current

4.3. Transmitter E-O Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
Center Wavelength Spacing	-	-	100	-	GHz
Center Wavelength	λ	X-100	X	X+100	pm [1]
Spectral Width (-20dB)	Δλ	-	-	0.3	nm
Side Mode Suppression Ratio	SMSR	30	-	-	dB
Average Optical Output Power	Po	0	-	+5	dBm
Extinction Ratio	Er	8.2	-	-	dB
Transmitter Enable Voltage	VEN	0	-	0.8	V
Transmitter Disable Voltage	VD	2.0	-	Vcc	V
Single Ended Data Input Swing	VINPP	250	-	1200	mV
Output Eye Diagram	Compliant with ITU recommendation G957				

Notes:
[1]   1. X = specified ITU center wavelength. (To See **«Ordering Information»**)

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4.4. Receiver O-E Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit
Operate Wavelength	-	1260	-	1620	nm
Sensitivity	Sen	-	-31.5	-28	dBm [1]
Saturation	Psat	-9	-	-	dBm [1]
LOS Asserted	-	-46	-	-	dBm [2]
LOS De-Asserted	-	-	-	-34	dBm [2]
LOS Hysteresis	-	-	1.5	-	dB
Single Ended Data Output Swing	VOUTPP	185	-	1000	mV
LOS Low Voltage	VLout	-	-	0.8	V
LOS High Voltage	VHout	2.0	-	-	V
Reflectance	-	-	-	-27	dB

Notes:
[1]   Sensitivity and Saturation levels for a 223-1 PRBS with 72 ones and 72 zeros inserted
[2]   High level: Alarm.

5. Pin Definition

5.1. Pin Diagram

20	VeeT
19	TD-
18	TD+
17	VeeT
16	VccT
15	VccR
14	VeeR
13	RD+
12	RD-
11	VeeR

Top of Board

1	VeeT
2	Tx Fault
3	Tx Disable
4	MOD-DEF(2)
5	MOD-DEF(1)
6	MOD-DEF(0)
7	Rate Select
8	LOS
9	VeeR
10	VeeR

Bottom of Board
(As viewed thru top of board)

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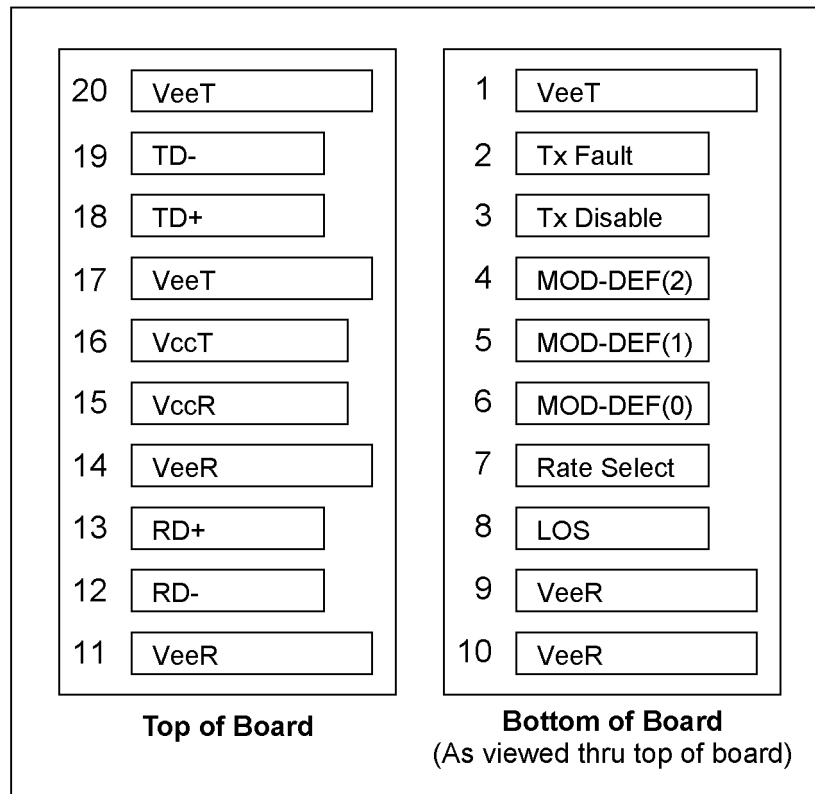
5.2. Pin Descriptions

Pin#	Name	Function
1	VeeT	Transmitter Ground
2	TX Fault	Transmitter Fault Indication [1]
3	TX Disable	Transmitter Disable [2, 9]
4	MOD-DEF2	Module Definition 2 [3, 10]
5	MOD-DEF1	Module Definition 1 [3, 10]
6	MOD-DEF0	Module Definition 0 [3, 11]
7	Rate Select	Not Use
8	LOS	Loss of Signal [4]
9	VeeR	Receiver Ground [5]
10	VeeR	Receiver Ground [5]
11	VeeR	Receiver Ground [5]
12	RD-	Inv. Received Data Out [6]
13	RD+	Received Data Out [6]
14	VeeR	Receiver Ground [5]
15	VccR	Receiver Power [7, 12]
16	VccT	Transmitter Power [7, 12]
17	VeeT	Transmitter Ground [5]
18	TD+	Transmit Data In [8]
19	TD-	Inv. Transmit Data In [8]
20	VeeT	Transmitter Ground [5]

Notes:

[1] TX Fault is an open collector/drain output, which should be pulled up with a 4.7K-10KΩ resistor on the host board. Pull up voltage between 2.0V and VccT, R+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 < 0.8V.

[2] TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7-10Ω resistor. Its states are:
Low (0 - 0.8V):   Transmitter on
(>0.8, < 2.0V):   Undefined
High (2.0 - 3.465V): Transmitter Disabled
Open: Transmitter Disabled

[3] 3. Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K - 10Ω resistor on the host board. The pull-up voltage shall be VccT or VccR.
Mod-Def 0 is grounded by the module to indicate that the module is present Mod-Def 1 is the clock line of two wire serial interface for serial ID Mod-Def 2 is the data line of two wire serial interface for serial ID

[4] LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K - 10Ω resistor. Pull up voltage between 2.0V and VccT, R+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 < 0.8V.

[5] VeeR and VeeT may be internally connected within the SFP module.

[6] 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.

[7]   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.

[8]   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.

[9]   Module disables on high or open.

[10]   2 wire serial ID interface.

[11]   Grounded in Module.
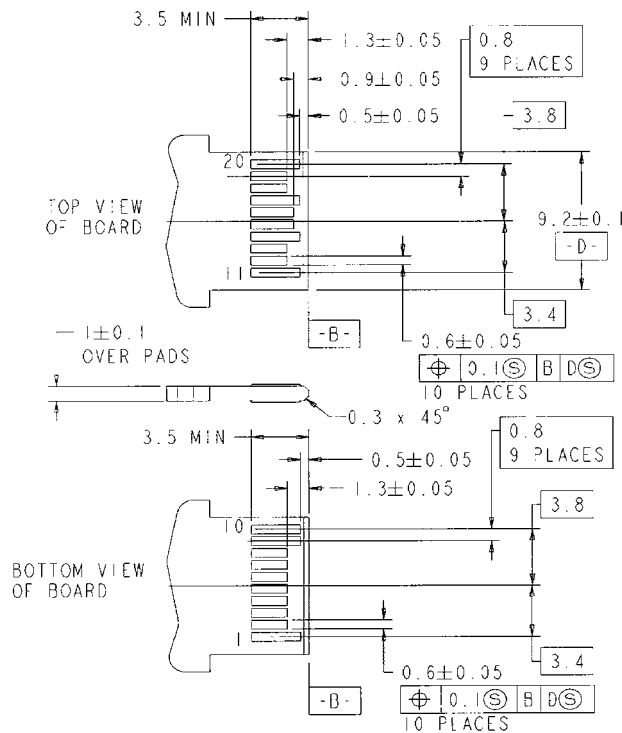
[12]   3.3V+ 5%.

6. Outline Dimensions
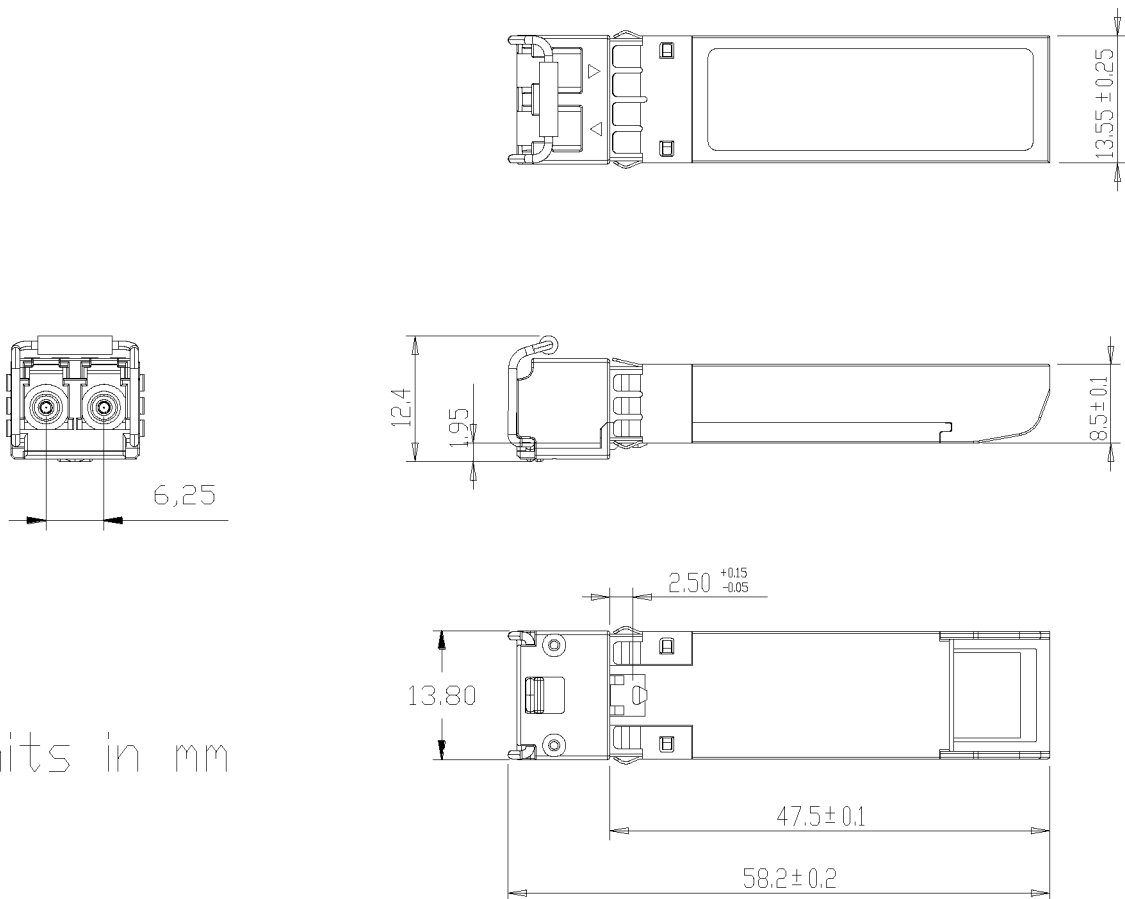
Units in mm

7. Recommended Circuit
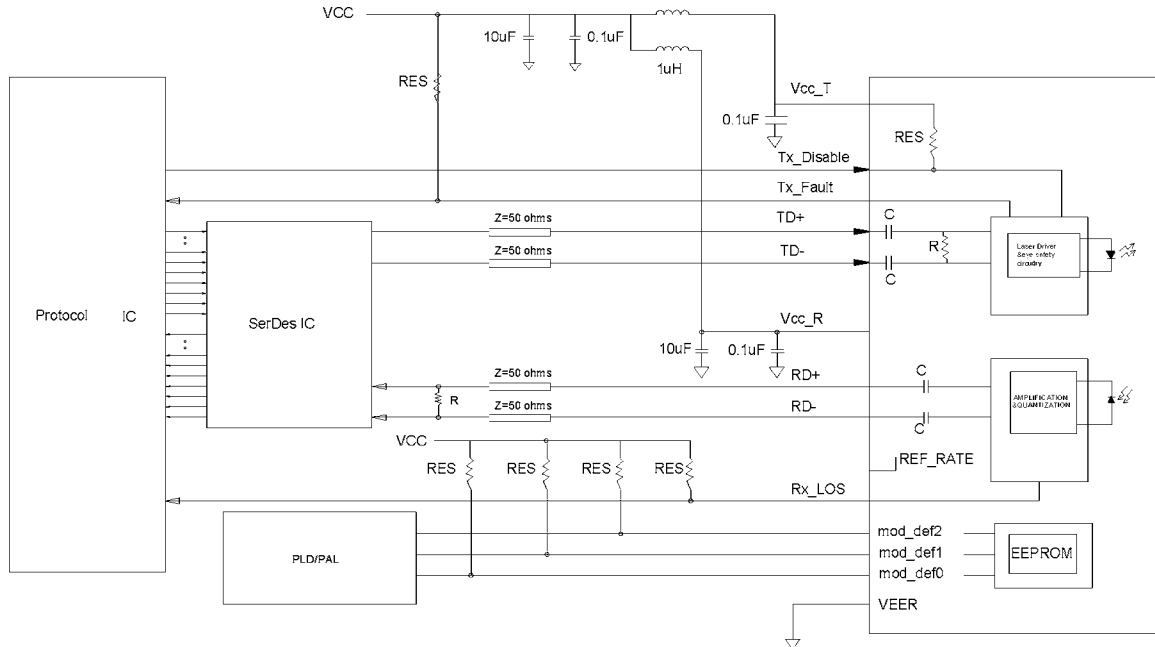
Note:
> 4.7 Kohms < RES < 10 Kohms

8. Pattern Layout of SFP Printed Circuit Board

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9. Ordering Information

Code	Center Wavelength (nm)	Frequency (THz)	Code	Center Wavelength (nm)	Frequency (THz)
C17	1563.86	191.7	C40	1545.32	194.0
C18	1563.05	191.8	C41	1544.53	194.1
C19	1562.23	191.9	C42	1543.73	194.2
C20	1561.42	192.0	C43	1542.94	194.3
C21	1560.61	192.1	C44	1542.14	194.4
C22	1559.79	192.2	C45	1541.35	194.5
C23	1558.98	192.3	C46	1540.56	194.6
C24	1558.17	192.4	C47	1539.77	194.7
C25	1557.36	192.5	C48	1538.98	194.8
C26	1556.55	192.6	C49	1538.19	194.9
C27	1555.75	192.7	C50	1537.40	195.0
C28	1554.94	192.8	C51	1536.61	195.1
C29	1554.13	192.9	C52	1535.82	195.2
C30	1553.33	193.0	C53	1535.04	195.3
C31	1552.52	193.1	C54	1534.25	195.4
C32	1551.72	193.2	C55	1533.47	195.5
C33	1550.92	193.3	C56	1532.68	195.6
C34	1550.12	193.4	C57	1531.90	195.7
C35	1549.32	193.5	C58	1531.12	195.8
C36	1548.51	193.6	C59	1530.33	195.9
C37	1547.72	193.7	C60	1529.55	196.0
C38	1546.92	193.8	C61	1528.77	196.1
C39	1546.12	193.9			