## Product Features

- Up to 25.78Gb/s bi-directional data links
- Electrical interface specifications per SFF-8431
- Management interface specifications per SFF-8432 and SFF-8472
- Build-in dual CDR with bypass function
- SFP28 MSA package with duplex LC connector
- DWDM-rated EML Transmitter
- APD receiver
- 100GHz ITU Grid, C-Band
- Up to 10km on 9/125um SMF
- Single +3.3V power supply
- Class 1 laser safety certified
- 2.0W maximum power consumption
- Operating temperature Options:
  Commercial: 0 to +70°C
  Industrial: -40 to +85°C

## Applications

- High speed storage area networks
- 25G high speed interconnection
- 25G DWDM Network
- CPRI/eCPRI

## Descriptions

The SP28-DWxxLR10x SFP28 transceivers are high performance,cost effective modules supporting data rate of 25.78Gbps and 10km transmission distance with SMF. The transceiver consists of three sections: a cooled EML DFB laser transmitter, a APD photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit. All modules satisfy class I laser safety requirements.

## Ordering Information

| Product part Number | Data Rate (Gbps) | Media | Wavelength (nm) | Transmission Distance(km) | Temperature Range $T_{case}$ / °C | |
|---|---|---|---|---|---|---|
| SP28-DWxxLR10C | 25.78 | SMF | 1528.77~1563.05 | 10 | 0~70 | Commercial |
| SP28-DWxxLR10I | 25.78 | SMF | 1528.77~1563.05 | 10 | -40~85 | Industrial |

**Table 2. Wavelength Guide for "xx" value (100GHz ITU-T channel)**

| Channel # | Product Part Number | Frequency (THz) | Center Wavelength (nm) |
|---|---|---|---|
| 18 | SP28-DW18LR10x | 191.8 | 1563.05 |
| 19 | SP28-DW19LR10x | 191.9 | 1562.23 |

| | | | |
|---|---|---|---|
| 20 | SP28-DW20LR10x | 192.0 | 1561.42 |
| 21 | SP28-DW21LR10x | 192.1 | 1560.61 |
| 22 | SP28-DW22LR10x | 192.2 | 1559.79 |
| 23 | SP28-DW23LR10x | 192.3 | 1558.98 |
| 24 | SP28-DW24LR10x | 192.4 | 1558.17 |
| 25 | SP28-DW25LR10x | 192.5 | 1557.36 |
| 26 | SP28-DW26LR10x | 192.6 | 1556.55 |
| 27 | SP28-DW27LR10x | 192.7 | 1555.75 |
| 28 | SP28-DW28LR10x | 192.8 | 1554.94 |
| 29 | SP28-DW29LR10x | 192.9 | 1554.13 |
| 30 | SP28-DW30LR10x | 193.0 | 1553.33 |
| 31 | SP28-DW31LR10x | 193.1 | 1552.52 |
| 32 | SP28-DW32LR10x | 193.2 | 1551.72 |
| 33 | SP28-DW33LR10x | 193.3 | 1550.92 |
| 34 | SP28-DW34LR10x | 193.4 | 1550.12 |
| 35 | SP28-DW35LR10x | 193.5 | 1549.32 |
| 36 | SP28-DW36LR10x | 193.6 | 1548.51 |
| 37 | SP28-DW37LR10x | 193.7 | 1547.72 |
| 38 | SP28-DW38LR10x | 193.8 | 1546.92 |
| 39 | SP28-DW39LR10x | 193.9 | 1546.12 |
| 40 | SP28-DW40LR10x | 194.0 | 1545.32 |
| 41 | SP28-DW41LR10x | 194.1 | 1544.53 |
| 42 | SP28-DW42LR10x | 194.2 | 1543.73 |
| 43 | SP28-DW43LR10x | 194.3 | 1542.94 |
| 44 | SP28-DW44LR10x | 194.4 | 1542.14 |
| 45 | SP28-DW45LR10x | 194.5 | 1541.35 |
| 46 | SP28-DW46LR10x | 194.6 | 1540.56 |
| 47 | SP28-DW47LR10x | 194.7 | 1539.77 |
| 48 | SP28-DW48LR10x | 194.8 | 1538.98 |
| 49 | SP28-DW49LR10x | 194.9 | 1538.19 |
| 50 | SP28-DW50LR10x | 195.0 | 1537.40 |
| 51 | SP28-DW51LR10x | 195.1 | 1536.61 |
| 52 | SP28-DW52LR10x | 195.2 | 1535.82 |
| 53 | SP28-DW53LR10x | 195.3 | 1535.04 |
| 54 | SP28-DW54LR10x | 195.4 | 1534.25 |
| 55 | SP28-DW55LR10x | 195.5 | 1533.47 |

| | | | |
|---|---|---|---|
| 56 | SP28-DW56LR10x | 195.6 | 1532.68 |
| 57 | SP28-DW57LR10x | 195.7 | 1531.90 |
| 58 | SP28-DW58LR10x | 195.8 | 1531.12 |
| 59 | SP28-DW59LR10x | 195.9 | 1530.33 |
| 60 | SP28-DW60LR10x | 196.0 | 1529.55 |
| 61 | SP28-DW61LR10x | 196.1 | 1528.77 |

## Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply Voltage | Vcc | -0.5 | 4.5 | V |
| Storage Temperature | Ts | -40 | +85 | °C |
| Operating Humidity | - | 5 | 85 | % |

## Recommended Operating Conditions

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Case Operating Temperature Range | Tc | 0 | - | 70 | °C |
| | | -40 | - | 85 | |
| Power Supply Voltage | Vcc | 3.135 | 3.30 | 3.465 | V |
| Power Supply Current | Icc | | | 600 | mA |
| Data Rate | | | 25.78 | - | Gbps |

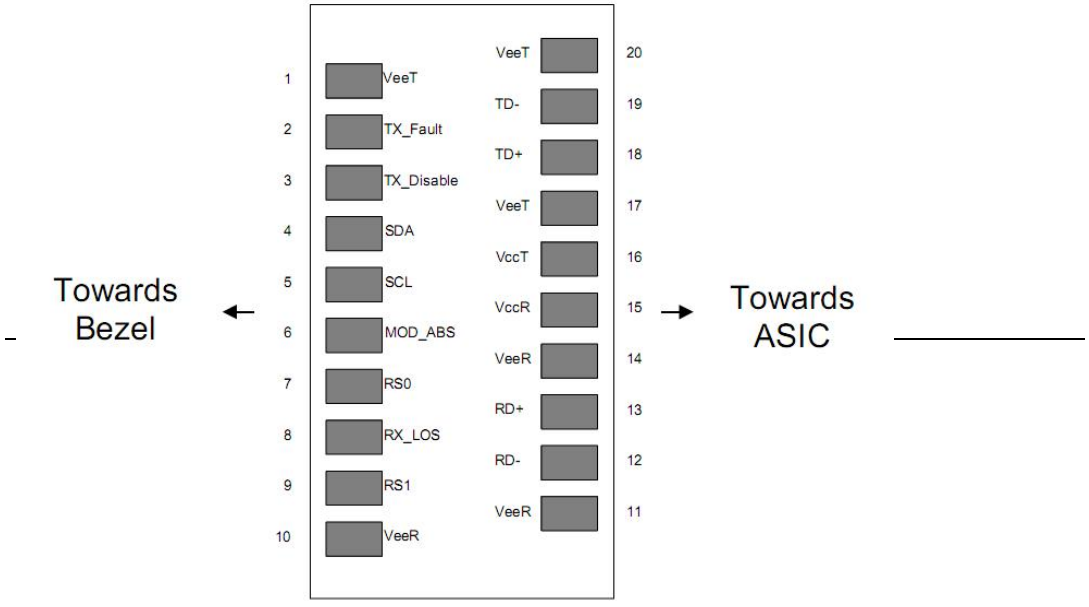
## Optical and Electrical Characteristics

| Parameter | | Symbol | Min | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|---|
| **Transmitter** | | | | | | | |
| Centre Wavelength Range | | λc | 1528.77 | - | 1563.05 | nm | |
| Spectral Width（-20dB） | | Δλ | | | 1 | nm | |
| Side-Mode Suppression Ratio | | SMSR | 30 | - | | dB | |
| Average Output Power | | $P_{out}$ | 0 | | +5.0 | dBm | 1 |
| Extinction Ratio | | ER | 4.5 | | | dB | |
| Data Input Swing Differential | | $V_{IN}$ | 180 | | 850 | mV | 2 |
| Input Differential Impedance | | $Z_{IN}$ | 90 | 100 | 110 | Ω | |
| TX Disable | Disable | | 2.0 | | Vcc | V | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Enable | | 0 | | 0.8 | V | |
| TX Fault | Fault | | 2.0 | | Vcc | V | |
| | Normal | | 0 | | 0.8 | V | |
| **Receiver** | | | | | | | |
| Centre Wavelength | | λc | 1528 | | 1565 | nm | |
| Receiver Sensitivity | | | | | -19 | dBm | 3 |
| Receiver Overload | | | -4.0 | | | dBm | 3 |
| LOS De-Assert | | $LOS_D$ | | | -19 | dBm | |
| LOS Assert | | $LOS_A$ | -35 | | | dBm | |
| LOS Hysteresis | | | 0.5 | | | dB | |
| Data Output Swing Differential | | $V_{out}$ | 300 | | 900 | mV | 4 |
| LOS | | High | 2.0 | | Vcc | V | |
| | | Low | | | 0.8 | V | |

**Notes:**
1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS $2^{31}$-1 test pattern @25.78Gbps, BER ≤5E×$10^{-5}$.
4. Internally AC-coupled.

## Pin Description



| Pin | Signal Name | Description | Plug Seq. | Notes |
|---|---|---|---|---|
| 1 | $V_{EET}$ | Transmitter Ground | 1 | |
| 2 | TX FAULT | Transmitter Fault Indication | 3 | Note 1 |
| 3 | TX DISABLE | Transmitter Disable | 3 | Note 2 |
| 4 | SDA | SDA Serial Data Signal | 3 | |
| 5 | SCL | SCL Serial Clock Signal | 3 | |
| 6 | MOD_ABS | Module Absent. Grounded within the module | 3 | |
| 7 | RS0 | Not Connected | 3 | |
| 8 | LOS | Loss of Signal | 3 | Note 3 |
| 9 | RS1 | Not Connected | 3 | |
| 10 | $V_{EER}$ | Receiver ground | 1 | |
| 11 | $V_{EER}$ | Receiver ground | 1 | |
| 12 | RD- | Inv. Received Data Out | 3 | Note 4 |
| 13 | RD+ | Received Data Out | 3 | Note 4 |
| 14 | $V_{EER}$ | Receiver ground | 1 | |
| 15 | $V_{CCR}$ | Receiver Power Supply | 2 | |
| 16 | $V_{CCT}$ | Transmitter Power Supply | 2 | |
| 17 | $V_{EET}$ | Transmitter Ground | 1 | |
| 18 | TD+ | Transmit Data In | 3 | Note 5 |
| 19 | TD- | Inv. Transmit Data In | 3 | Note 5 |
| 20 | $V_{EET}$ | Transmitter Ground | 1 | |

Notes:
Plug Seq.: Pin engagement sequence during hot plugging.
1) TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
2) Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3) LOS is open collector output. Should be pulled up with 4.7k~10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
4) RD-/+: These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100Ω (differential) at the user SERDES.
5) TD-/+: These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.

# Recommended Host Board Power Supply Filter Network

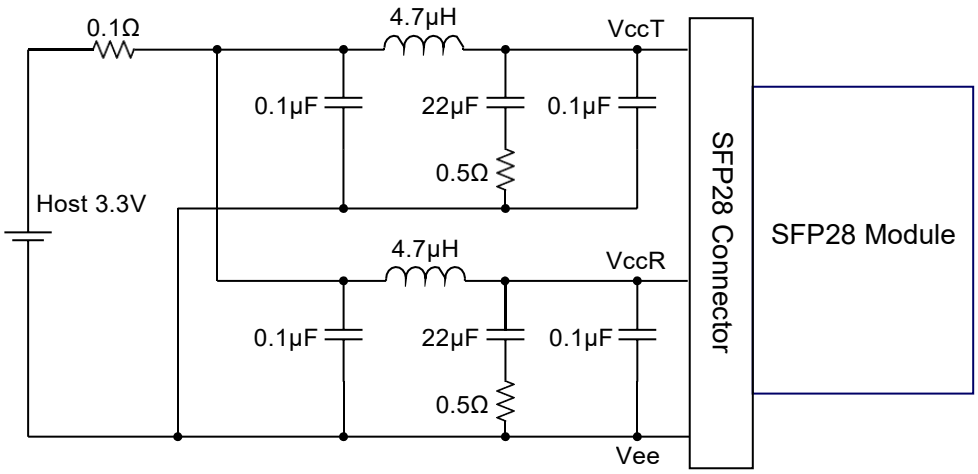



Figure 2. Recommended Host Board Power Supply Filter Network

# Recommended Application Interface Block Diagram

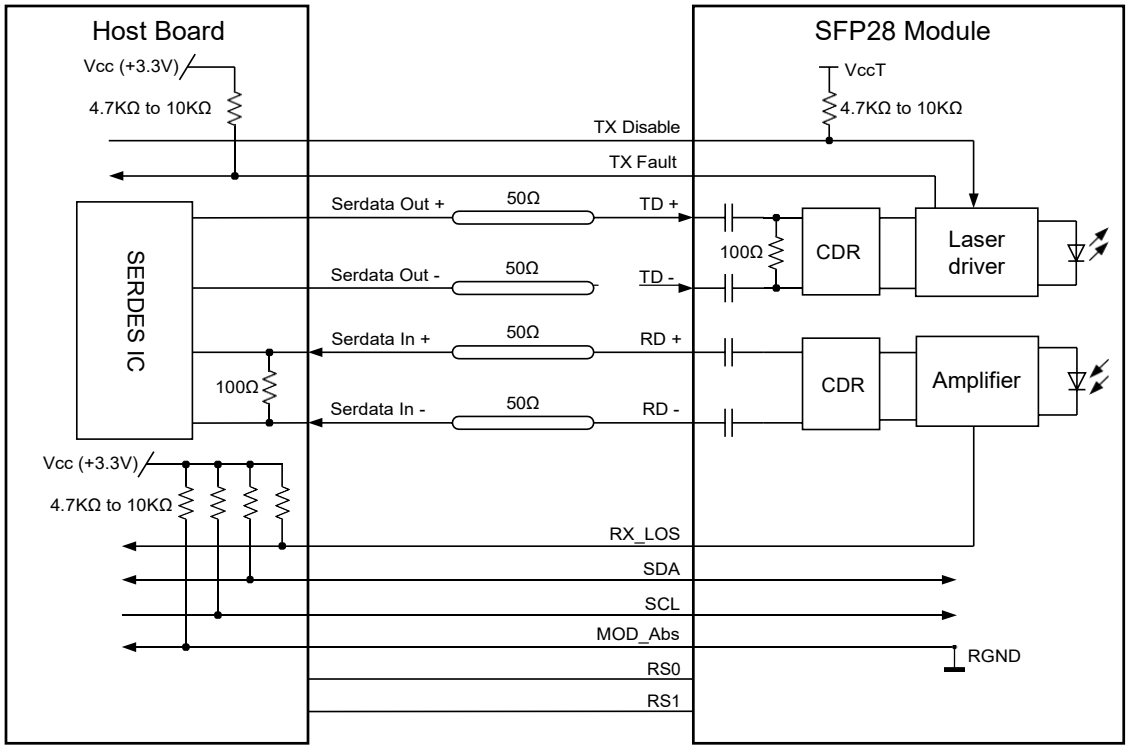
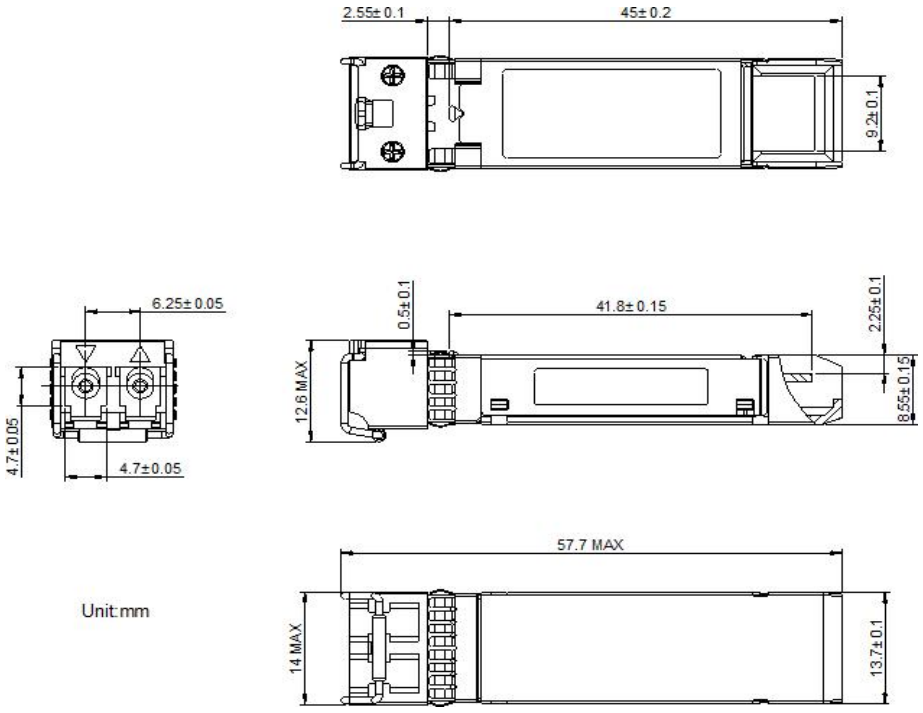



Figure 3. Recommended Application Interface Block Diagram

# Mechanical specifications

Figure 4. Outline Drawing



# PCB layout recommendation

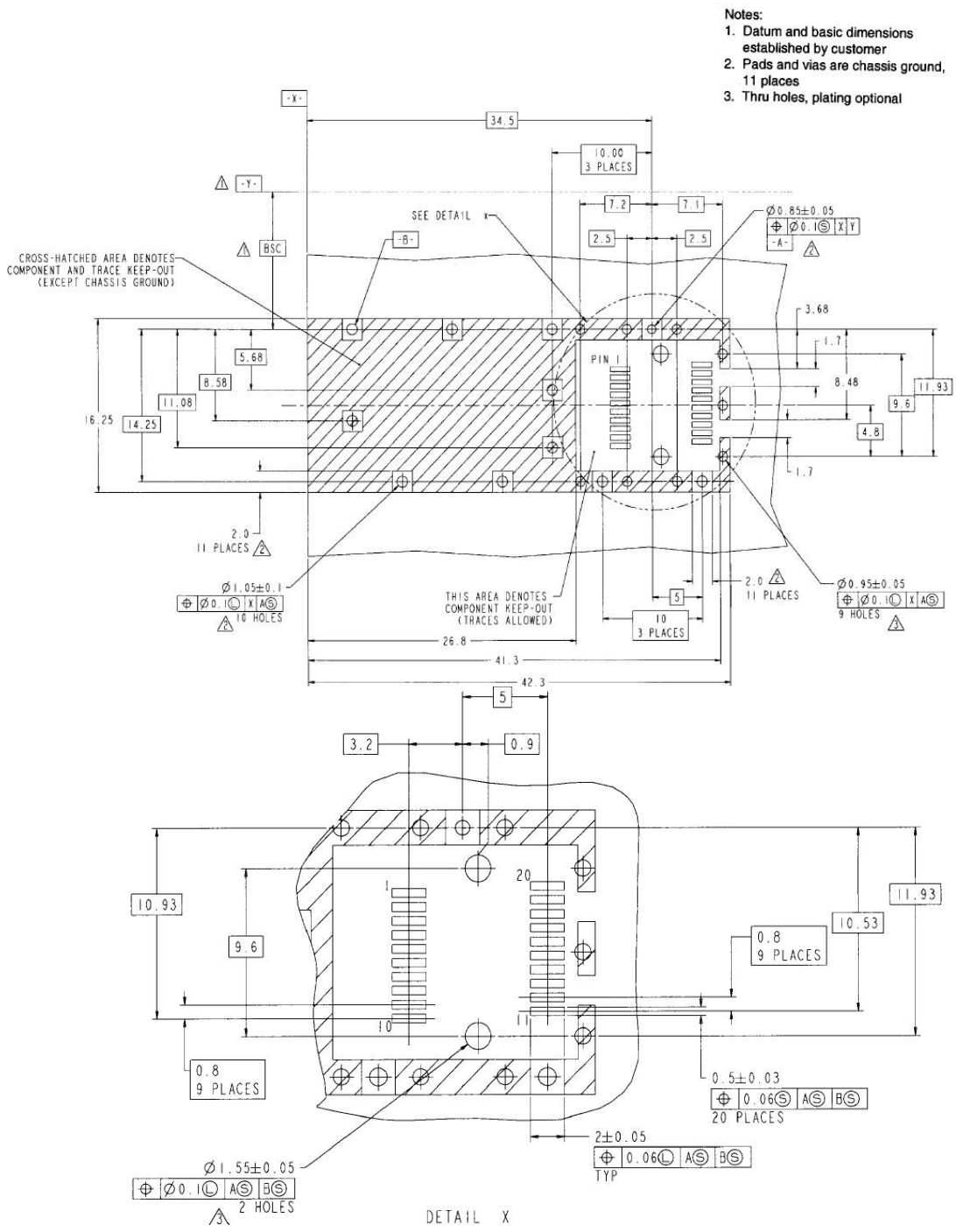



Figure 5. PCB layout recommendation

# Regulatory Compliance

| Feature | Reference | Performance |
|---|---|---|
| Electrostatic discharge（ESD） | IEC/EN 61000-4-2 | Compatible with standards |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B EN 55022 Class B (CISPR 22A) | Compatible with standards |
| Laser Eye Safety | IEC/EN 60825-1, 2 | Class 1 laser product |
| ROHS | 2002/95/EC | Compatible with standards |
| EMC | EN61000-3 | Compatible with standards |