

CSFP 1.25G 2Channel

1000BASE-BX 1490nmTx/1310nmRx 20KM

SPT-W431G-20D

Features

- ◆ LC Duplex optical interface
- ◆ 20km reach
- ◆ 1250Mb/s data rate
- ◆ +3.3V power supply
- ◆ Low DC power consumption
- ◆ Comply with CSFP MSA Option2
- ◆ Bail Latch
- ◆ Hot swappable
- ◆ 2 Channel Bidirectional Optical Transceiver unit :
 - 1490nm DFB laser
 - 1310nm PIN/TIA receiver
- ◆ Single Mode operation
- ◆ BER < 1X10⁻¹² (PRBS 27 - 1 NRZ test pattern)
- ◆ IEEE 802.3ah 1000BASE-BX compliant
- ◆ Case operating temperature ranges:
 - Commercial: 0 to 70°C
 - Industrial: -40 to 85°C
- ◆ Monitor and Control Functions
 - Loss of Signal (Rx1_LOS,Rx2_LOS), LVTTL
 - Tx Disable (Tx1_DIS,Tx2_DIS), LVTTL
 - Tx Fault (Tx_FAULT), LVTTL
 - 2-wire I2C data bus
 - SFF-8472 Rev 9.5 MSA compliant
- ◆ Internally AC coupled and terminated

- ◆ RoHS compliance

Applications

- ◆ 1250Mb/s Gigabit Ethernet data links
- ◆ Channel extenders
- ◆ Bus extenders
- ◆ High speed I/O file servers
- ◆ Data storage networks
LAN, SAN, RSAN
- ◆ Host adapters
- ◆ Switch-to-switch interfaces
- ◆ Mass storage system interconnects
- ◆ Hub interconnects
- ◆ Router interconnects
- ◆ Distributed multi-processing
- ◆ Telecom switches

Product Description

The SPT-W431G-20D CSFP 1000BASE-BX LC 2-Channel bidirectional transceiver is intended for 20km reach service in 1250Mb/s single mode high-speed LAN and SAN data communications equipment where low-cost, extraordinary performance and reliability are essential. It meets the requirements of IEEE802.3ah 1000BASE-BX, consumes low power, operates from a 3.3V DC power supply and is offered in the commercial and industrial temperature ranges. The industry standard 2x10 compact small form pluggable (CSFP) package is fabricated with a rugged die cast metal housing and cage assembly. The low jitter and low bit error rate optical assembly features a 1490nm DFB laser transmitter and 1310nm PIN/TIA receiver. It incorporates the CSFP MSA LVTTTL Loss of Signal (Rx_LOS), Tx Fault (Tx_FAULT) and Tx Disable (Tx_DIS) monitor and control functions and the SFF-8472 Rev9.5 compliant digital diagnostic monitor feature which is accessed via the I²C 2-wire serial ID interface. The device is Class I laser safety compliant.

Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Units |
|-----------------------------|--------|-----|-----|-------|
| Storage Ambient Temperature | Tstg | -40 | +85 | °C |

| | | | | |
|-------------------------------|-----|---|---------|---|
| Relative Humidity - Storage | RHS | 0 | 95 | % |
| Relative Humidity - Operating | RHO | 0 | 85 | % |
| Module Supply Voltage | VCC | 0 | 3.6 | V |
| TX DATA | Vin | 0 | Vcc+0.5 | V |

Optical and Electrical Signal Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Units |
|--|-----------|-----|-----|-------|
| Signal / Data Input Voltage (Tx_DATA) | VIN PK-PK | - | 2.4 | V |
| 8472 Clock Signal (Standard Mode) | ICLOCK | - | 100 | kHz |
| 8472 Clock Signal (Fast Mode) | ICLOCK | - | 400 | kHz |
| Rx Optical Input Power | PIN-MAX | - | 3 | dBm |

Logic State Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Units |
|------------------------------|----------|-----|---------|-------|
| Tx1_DISABLE Logic HIGH State | Tx1_DIS | - | VCC+0.5 | V |
| Tx2_DISABLE Logic HIGH State | Tx2_DIS | - | VCC+0.5 | V |
| Tx_FAULT Logic HIGH State | Tx_FAULT | - | VCC+0.5 | V |
| Rx1_LOS Logic HIGH State | Rx1_LOS | - | VCC+0.5 | V |
| Rx2_LOS Logic HIGH State | Rx2_LOS | - | VCC+0.5 | V |
| 8472 MOD-DEF | MOD_DEF | - | VCC+0.5 | V |

Recommended Operating Conditions

| Parameter | Symbol | Min | Typ | Max | Units | Notes |
|----------------------------|--------|------|-----|-------|-------|-----------------------|
| Case Operating Temperature | Tcase | 0 | +25 | 70 | °C | Temperature Range = C |
| | | -40 | +25 | +85 | °C | Temperature Range = H |
| Module Supply Voltage | VCC | 3.14 | 3.3 | 3.465 | V | |
| Module Supply Current | IIN | | | 250 | mA | |

Transmitter Electrical Characteristic

| Parameter | Symbol | Min | Typ | Max | Units | Notes |
|------------------------------------|--------|-----|-----|---------|-------|--------------------------------------|
| Tx_Data Differential Input Voltage | VIN | 300 | - | 2400 | mV | Internally AC coupled and terminated |
| Tx Differential Input Impedence | ZIN | - | 100 | - | | |
| Tx1_DISABLE Logic HIGH State | VTDH1 | 2.4 | - | VCC+0.3 | V | |
| Tx1_DISABLE Logic LOW State | VTDL1 | 0 | - | 0.8 | V | |
| Tx2_DISABLE Logic HIGH State | VTDH2 | 2.4 | - | VCC+0.3 | V | |
| Tx2_DISABLE Logic LOW State | VTDL2 | 0 | - | 0.8 | V | |

| | | | | | | |
|---------------------------|------|-----|---|---------|---|--|
| Tx_FAULT Logic HIGH State | VTFH | 2.4 | - | VCC+0.3 | V | |
| Tx_FAULT Logic LOW State | VTFL | 0 | - | 0.8 | V | |

Receiver Electrical Characteristics

| Parameter | Symbol | Typ | Max | Units | Notes | Typ |
|-------------------------------------|--------|-----|-----|---------|-------|--------------------------------------|
| Rx_Data Differential Output Voltage | VOUT | 200 | - | 1800 | mV | Internally AC coupled and terminated |
| Rx Differential Output Impedance | ZOUT | - | 100 | - | | |
| Rx1_LOS Logic HIGH State | VRLH1 | 2.4 | - | VCC+0.3 | V | |
| Rx1_LOS Logic LOW State | VRL11 | 0 | - | 0.8 | V | |
| Rx2_LOS Logic HIGH State | VRLH2 | 2.4 | - | VCC+0.3 | V | |
| Rx2_LOS Logic LOW State | VRL22 | 0 | - | 0.8 | V | |

Transmitter Optical Characteristics

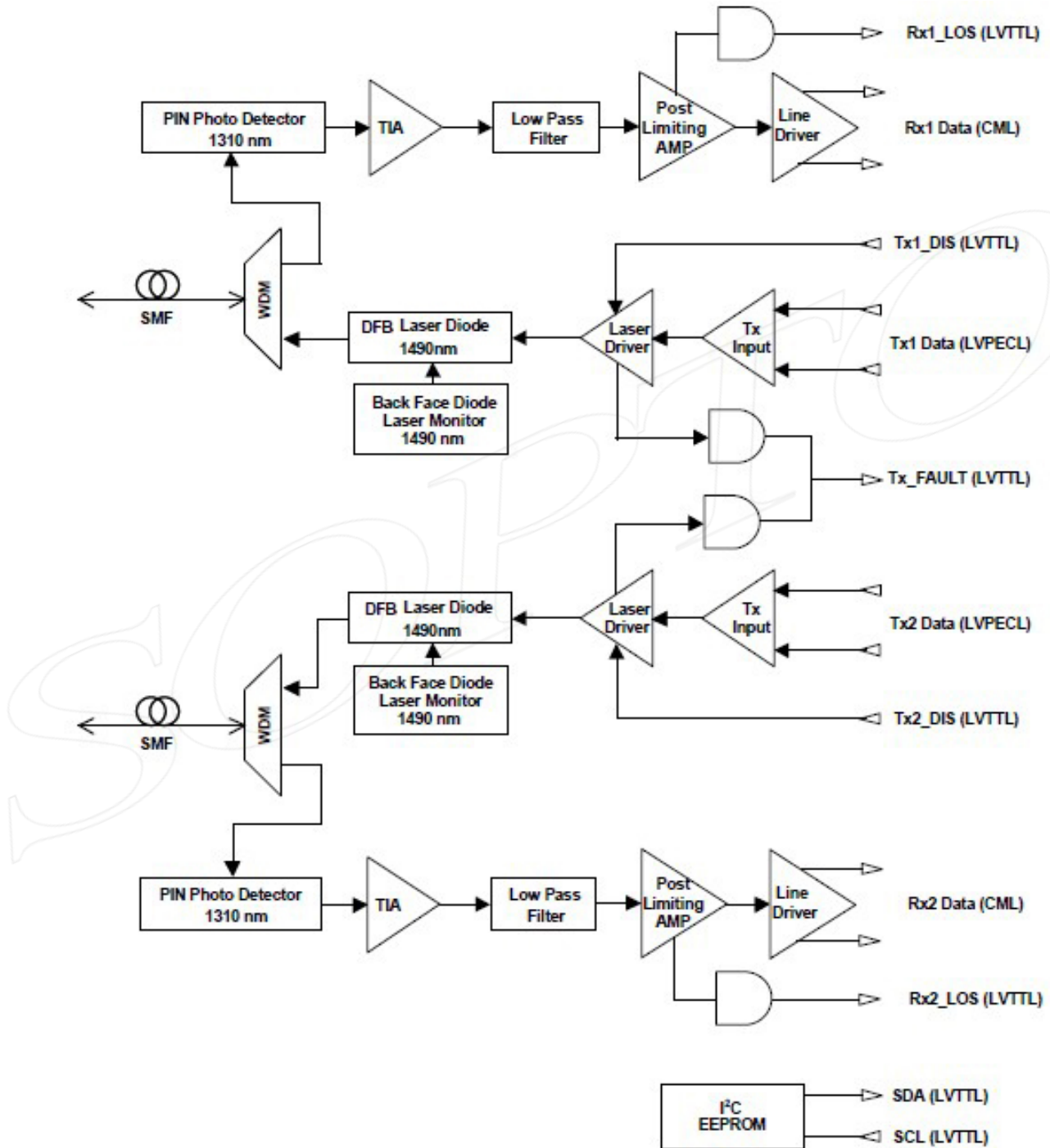
| Parameter | Symbol | Min | Typ | Max | Units | Conditions / Notes |
|-----------------------------|------------------------------------|------------|------|------|-------|------------------------|
| Transmitter Type | | 1490nm DFB | | | | |
| Optical Launch Power | POUT | -9 | - | -3 | dBm | Average Optical Output |
| Optical Center Wavelength | λ | 1480 | 1490 | 1500 | nm | |
| Spectral Line Width@-20dB | λ | - | - | 1 | nm | |
| Side Mode Suppression Ratio | SMSR | 30 | - | - | dB | |
| Extinction Ratio | ER | 9 | - | - | dB | |
| Optical Rise and Fall Time | tr/ta | - | - | 260 | ps | 20% - 80% |
| Relative Intensity Noise | RIN | - | - | -120 | dB/Hz | |
| Peak to Peak Jitter | JP-P | - | - | 0.2 | UI | |
| Output Eye | IEEE 802.3ah 1000BASE-BX Compliant | | | | | |

Receiver Optical Characteristics

| Parameter | Symbol | Min | Typ | Max | Units | Notes |
|---------------------------|-----------|-----------|------|------|-------|---------------------------------|
| Receiver Type | | PIN / TIA | | | | |
| Receiver Sensitivity | PIN | - | - | -23 | dBm | Average Received Power (Note 1) |
| Receiver Optical Overload | PIN(MAX) | -3 | - | - | dBm | Average Received Power (Note 1) |
| Optical Center Wavelength | λ | 1260 | 1310 | 1360 | nm | |
| Receiver Reflectance | RFL | - | - | -12 | dB | |
| Rx_LOS of Signal Assert | PA | -45 | - | - | dBm | |

| | | | | | | |
|---|-----|-----|---|-----|-----|--|
| Rx_LOS of Signal Deassert | PD | - | - | -23 | dBm | |
| Rx_LOS of Signal Hysteresis | PHy | 0.5 | - | 5 | dB | |
| Note 1: Average received power where the BER = 10^{-12} , measured with a PRBS 2^7-1 NRZ test pattern | | | | | | |

Block Diagram



Memory Map

Two-wire interface Serial ID: Data Fields –Address A0h/B0h for each channel

| EEPROM serial ID memory contents (A0h/B0h) | | | | |
|--|------|----------------------------|--|-------------------------|
| Address | Size | Name of Field | Description | Values (HEX) |
| 0 | 1 | Identifier | SFP | 03 |
| 1 | 1 | Ext. Identifier | | 04 |
| 2 | 1 | Connector | LC | 07 |
| 3-10 | 8 | Transceiver | 1000BASE-BX | 00 00 00 40 00 00 00 00 |
| 11 | 1 | Encoding | 8B10B | 01 |
| 12 | 1 | BR, Nominal | 1250Mb/s | 0D |
| 13 | 1 | Reserved | Reserved | 00 |
| 14 | 1 | Length(9μm)-km | 20km Link Length in Kilometers = SMF | 14 |
| 15 | 1 | Length (9μm)-100m | 20km Link Length in Hundreds of Meters = SMF | C8 |
| 16 | 1 | Length (50μm)-10m | 50-micron MMF Link Length = N/A | 00 |
| 17 | 1 | Length (62.5μm)-10m | 62.5-micron MMF Link Length = N/A | 00 |
| 18 | 1 | Length (Copper) | Copper Link Length = N/A | 00 |
| 19 | 1 | Reserved | Reserved | 00 |
| 20-35 | 16 | Vendor name | “Sopto” | ASCII Format |
| 36 | 1 | Reserved | Reserved | 00 |
| 37-39 | 3 | Vendor OUI | | 00 00 00 |
| 40-55 | 16 | Vendor PN | The Part Number in the Ordering Information | ASCII Format |
| 56-59 | 4 | Vendor Rev | Programmed by Factory | ASCII Format |
| 60-61 | 2 | Wavelength | 1490nm Laser Wavelength | 05 D2 |
| 62 | 1 | Reserved | Reserved | 00 |
| 63 | 1 | CC_BASE | Check sum of bytes 0-62 | Programmed by Factory |
| 64-65 | 2 | Transceiver Options | 1. Rx_LOS 2. Tx_FAULT 3. Tx_DISABLE | 00 1A |
| 66 | 1 | BR, max | 20% | 14 |
| 67 | 1 | BR, min | 20% | 14 |
| 68-83 | 16 | Vendor SN | Programmed by Factory | ASCII Format |
| 84-91 | 8 | Date code | Year, Month, Day | Programmed by Factory |
| 92 | 1 | Diagnostic Monitoring Type | Compliant with SFF-8472 V9.5 externally Calibrated Received power measurement type-Average Power | 58 |
| 93 | 1 | Enhanced Options | 1. Optional Alarm/warning implemented | F0 |

| | | | | |
|---------|-----|---------------------|--|-----------------------|
| | | | 2. Soft Tx_DISABLE control and monitor 3. Soft Tx_FAULT monitor 4. Soft Rx_LOS monitor | |
| 94 | 1 | SFF-8472 Compliance | Diagnostics Compliance(SFF-8472 V9.5) | 02 |
| 95 | 1 | CC_EXT | Check sum of bytes 64-94 | Programmed by Factory |
| 96-127 | 32 | Vendor Specific | Vendor Specific | Programmed by Factory |
| 128-255 | 128 | Vendor Specific | Vendor Specific | Programmed by Factory |

PAGE A2/B2 (HEX) SFF 8472 REVISION 9.5 DIGITAL DIAGNOSTICS

Data Fields –Address A2h/B2h for each channel.

Page A2h/B2h (HEX) contains the ALARM, WARNING and ACTUAL data for 5 different transceiver parameters. The information is stored in the "two's-complement" format with the MSB occupying the lower

byte and the LSB occupying the higher byte as shown in the table below. For each of the 5 parameters there are 10 memory locations:

1. High ALARM Value
2. Low ALARM Value
3. High WARNING Value
4. Low WARNING Values
5. Real Time Data

When an ALARM or WARNING value is reached, a FLAG is set that can be read by the I2C serial interface. The FLAG is a single bit in a specific 8-bit memory location. It is possible to have several ALARM and WARNING FLAGS set within a single 8-bit byte. In the table below, bytes 112, 113, 116 and 117 are the FLAG memory locations and the number in the parenthesis is the bit location with the 8-bit byte.

| 8472 Parameter | Alarm Threshold Data | | | | Warning Threshold Data | | | | Measured Values | | Alarm Bit (Set) Address + Position | | Warning Bit (Set)Address + Position | |
|----------------|----------------------|----|-----------|----|------------------------|----|-----------|----|-----------------|-----|------------------------------------|---------|-------------------------------------|---------|
| | High Value | | Low Value | | High Value | | Low Value | | | | High | Low | High | Low |
| | M | L | M | L | M | L | M | L | M | L | | | | |
| Temperature | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 96 | 97 | 112 (7) | 112 (6) | 116 (7) | 116 (6) |
| Vcc | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 98 | 99 | 112 (5) | 112 (4) | 116 (5) | 116 (4) |
| Tx Bias | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 100 | 101 | 112 (3) | 112 (2) | 116 (3) | 116 (2) |
| Tx Out | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 102 | 103 | 112 (1) | 112 (0) | 116 (1) | 116 (0) |
| Rx Input | 32 | 33 | 43 | 35 | 36 | 37 | 38 | 39 | 104 | 105 | 113 (7) | 113 (8) | 117 (7) | 117 (6) |

Channel Shut down Control

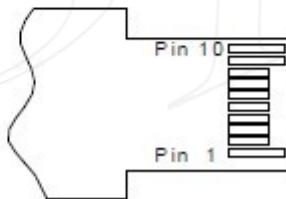
| Data Address (Dec) | Size (bit) | Name | Description |
|--------------------|------------|---------------------------|--|
| 110 | 5 | Channel Shut down Control | Read/write bit allows shutting down CH1 or CH2 Power supply and CH1 or CH2 is under the low power dissipation mode. Users can shut down CH1 or CH2 by presetting to “1” and turn on CH1 or CH2 by presetting to “0”. Default power up value is zero/low. |

PIN Assignment

TOP VIEW OF BOARD



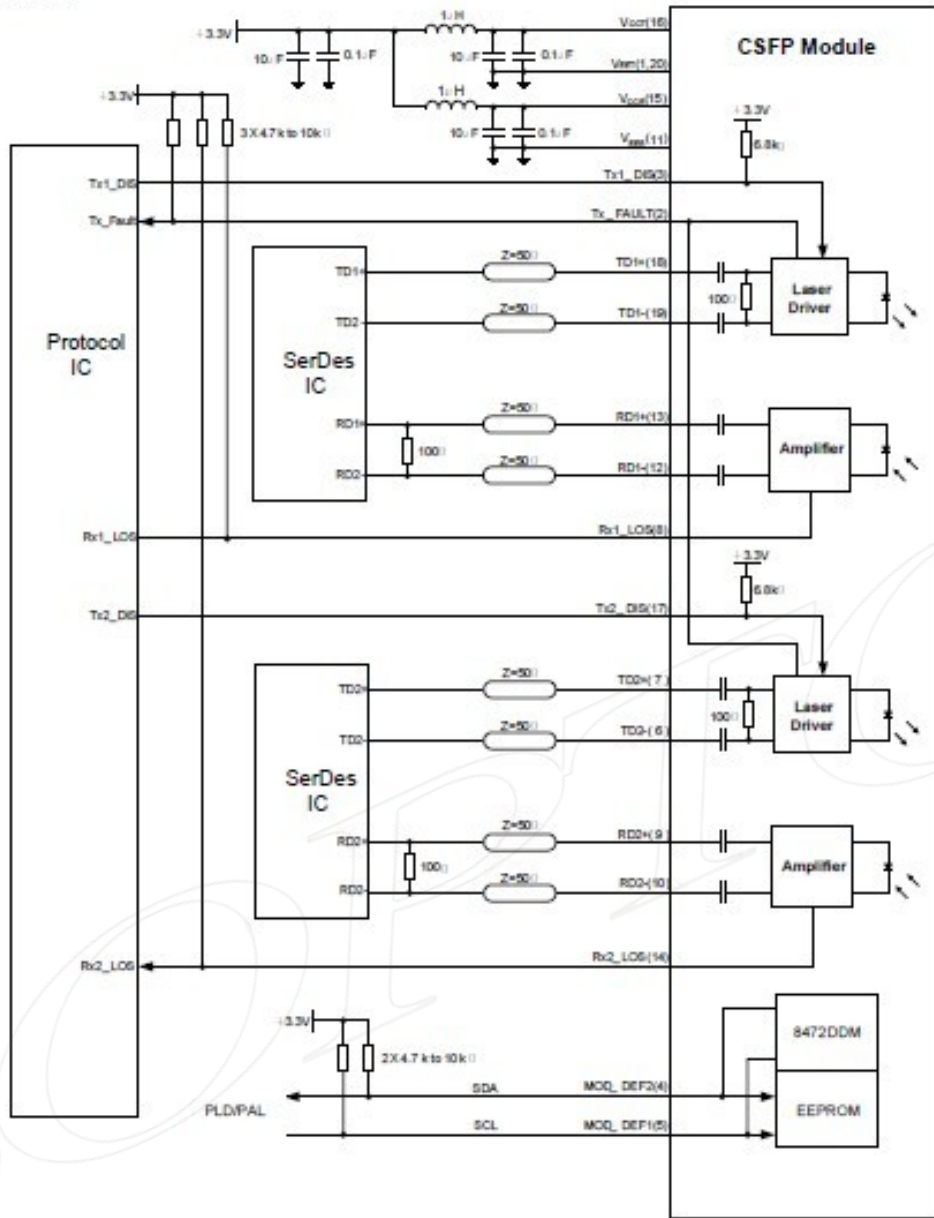
BOTTOM VIEW OF BOARD



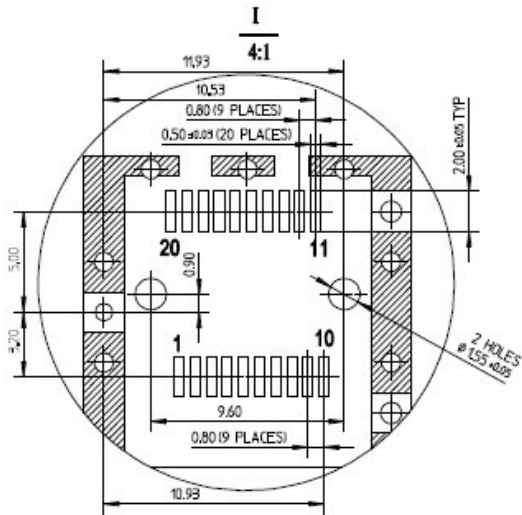
SFP PIN Description

| PIN | Symbol | Description | Notes |
|--|-----------|--|--------------|
| 1 | VEET | Transmitter Ground | |
| 2 | Tx_FAULT | Transmitter Fault, LOW = Normal Operation, HIGH = Fault Indication | 1 |
| 3 | Tx1_DIS | Transmit Disable, ch1 | 1 |
| 4 | MOD_DEF 2 | Module Definition 2 - Two-Wire Interface - Serial Data | 1 |
| 5 | MOD_DEF 1 | Module Definition 1 - Two-Wire Interface - Clock Signal | 1 |
| 6 | TD 2- | Tx_Data Input (Inverted) ch2 | 3 |
| 7 | TD 2+ | Tx_Data Input (Non Inverted) ch2 | 3 |
| 8 | Rx1_LOS | Receiver Loss of Signal,ch1 | 1 |
| 9 | RD 2+ | Rx_Data Output (Non Inverted) ch2 | |
| 10 | RD 2- | Rx_Data Output (Inverted) ch2 | |
| 11 | VEER | Receiver Ground | |
| 12 | RD 1- | Rx_Data Output (Inverted) ch1 | 2 |
| 13 | RD 1+ | Rx_Data Output (Non Inverted) ch1 | 2 |
| 14 | Rx2_LOS | Receiver Loss of Signal,ch2 | |
| 15 | VCCR | Receiver DC Power | 3.3 V +/- 5% |
| 16 | VCCT | Transmitter DC Power | 3.3 V +/- 5% |
| 17 | Tx2_DIS | Transmit Disable, ch2 | |
| 18 | TD 1+ | Tx_Data Input (Non Inverted),ch1 | 3 |
| 19 | TD 1- | Tx_Data Input (Inverted),ch1 | 3 |
| 20 | VEET | Transmitter Ground | |
| <ol style="list-style-type: none"> The uncommitted Tx_Fault, Rx_LOS, MOD_DEF 1 and MOD_DEF 2 LVTTTL monitor and control pins each require a pull up resistor of 4.7k to 10k Ohms. The 100Ohms differential Rx Data output is internally AC coupled and must be terminated with 100 Ohms at the differential user interface. The 100Ohms differential Tx Data input is internally AC coupled and terminated. | | | |

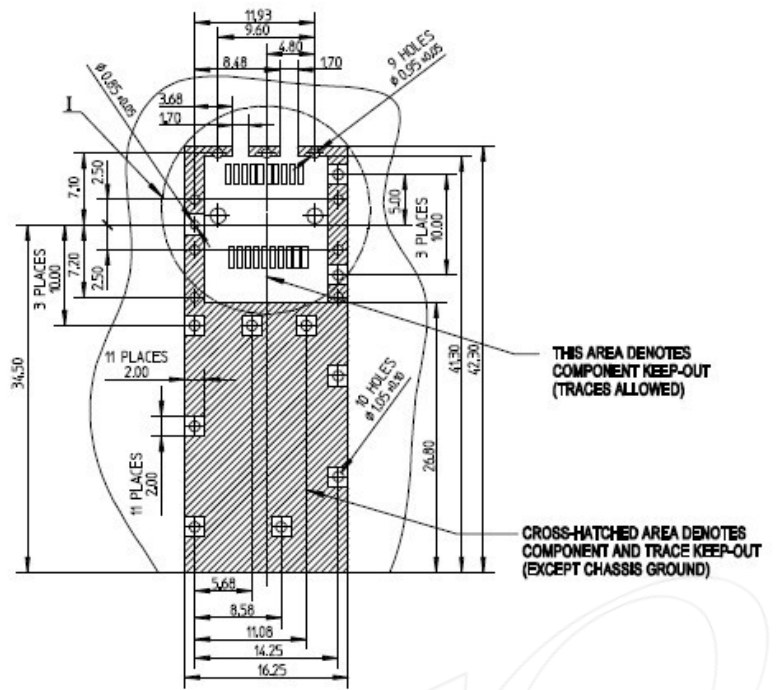
Electrical Interface



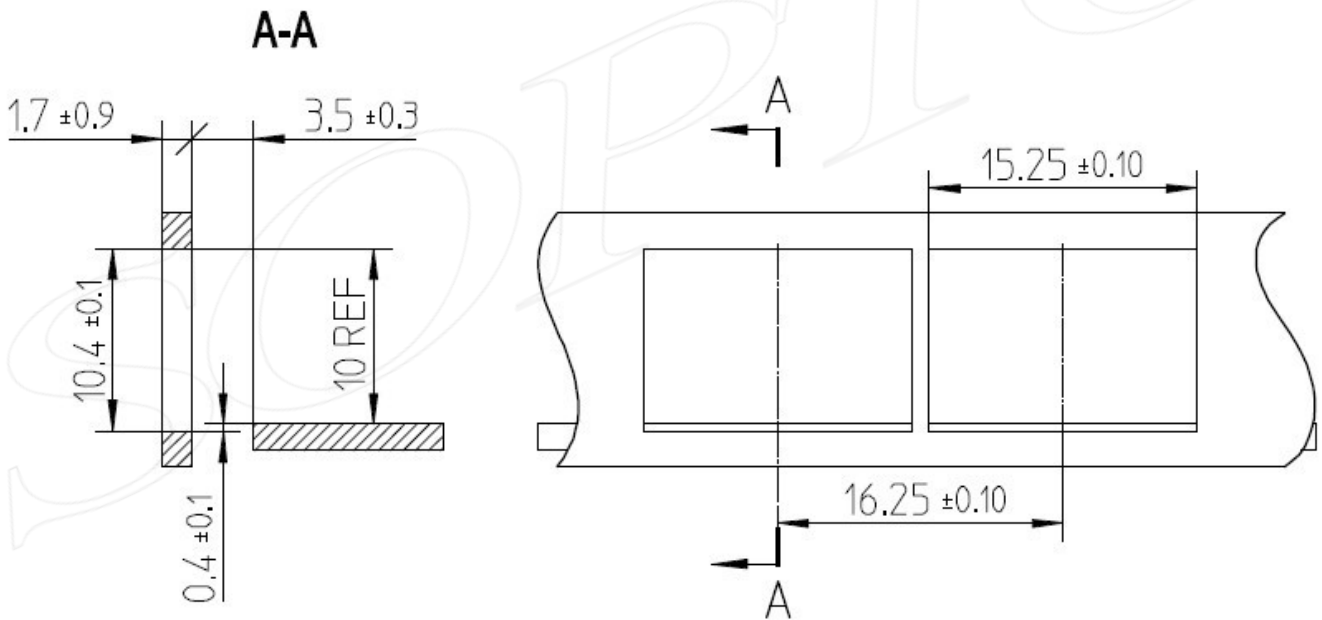
Recommended PCB Layout



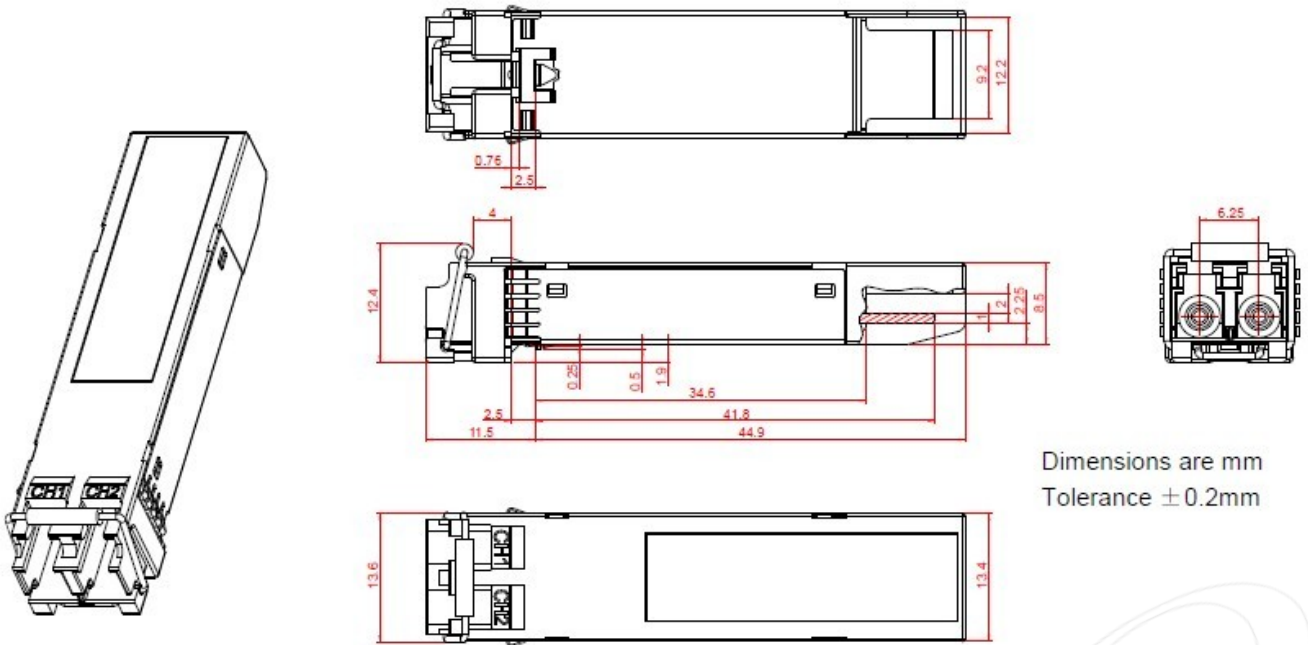
- Notes:**
1. Datum and basic dimensions established by customer
 2. Pads and vias are chassis ground, 11 places
 3. Thru holes, plating optional



Recommended Front Panel Layout Opening for LC



Mechanical Dimensions



Ordering information

| Part Number | Product Description |
|---------------|---|
| SPT-W431G-20D | CSFP 1.25G 2Channel 1490T/1310R 20KM, 0°C ~ +70°C, With DDM |

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