# 6G-SDI Video SFP 1310nm 20km Optical Transceiver
## GHP-316G-L2CD

## Features

♦ SD/HD/3G/6G-SDI SFP Transceiver available

♦ SMPTE ST-297-2015, ST-2081Compatible

♦ Metal enclosure for Lower EMI

♦ 1310nm DFB laser

♦ Supports video pathological patterns for SD-SDI, HD-SDI, 3G-SDI and 6G-SDI

♦ Compliant with SFP MSA and SFF-8472 with duplex LC receptacle

♦ Digital Diagnostic functions available through the I2C interface

♦ Compatible with RoHS

♦ +3.3V single power supply

♦ Operating case temperature:
Standard：0 to +70°C

## Applications

♦ SMPTE ST-297-2015 and ST-2081 Compatible Electrical-to-Optical Interfaces.

♦ UHDTV/HDTV/SDTV Service Interfaces.

## Description

The video series transceivers are high performance, cost effective modules for duplex video transmission application over single mode fiber.

The transceiver is designed to transmit/receive data rates from 50Mbps to 5.94Gbps and is specifically designed for robust performance in the presence of SDI pathological patterns for SMPTE 259M, SMPTE 344M, SMPTE 292M, SMPTE 424M and ST-2081 serial rates.

The transceiver consists of three sections: a DFB laser, a PIN photodiode integrated with a

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trans-impedance preamplifier (TIA) and transceiver IC with MCU control unit for DDM. All modules satisfy class I laser safety requirements.

The transceivers are compatible with SFP Multi-Source Agreement (MSA) and SFF-8472. For further information, please refer to SFP MSA.
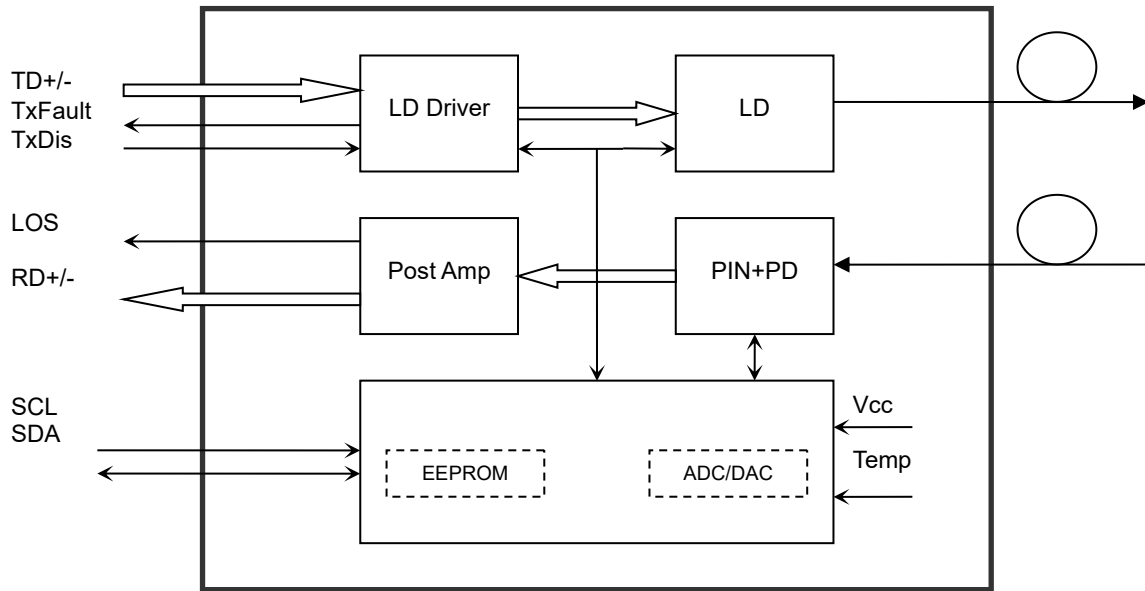


## Absolute Maximum Ratings

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

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## Recommended Operating Conditions

| Parameter | | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|---|
| Operating Case Temperature | Standard | Tc | 0 | | +70 | °C |
| | | | | | | °C |
| Power Supply Voltage | | Vcc | 3.13 | 3.3 | 3.47 | V |
| Power Supply Current | | Icc | | 200 | 300 | mA |
| Data Rate | | | | 6 | | Gbps |

## Optical and Electrical Characteristics

| Parameter | | Symbol | Min | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|---|
| Transmitter | | | | | | | |
| Centre Wavelength | | λc | 1300 | 1310 | 1320 | nm | |
| Spectral Width (-20dB) | | σ | | | 1 | nm | |
| Side Mode Suppression Ratio | | SMSR | 30 | | | dB | |
| Average Output Power | | Pout | -5 | | -2 | dBm | 1 |
| Extinction Ratio | | ER | 7 | | | dB | |
| Rise/Fall Time (20%~80%) | SD-SDI | tr/tf | | | 1500 | ps | 2 |
| | HD-SDI | | | | 270 | | |
| | 3G-SDI | | | | 135 | | |
| | 6G-SDI | | | | 80 | | |
| | | | | | | | |
| Output Jitter | Timing Jitter | SD-SDI | | | 0.2 | UI | 6 |
| | | HD-SDI | | | 1 | | |
| | | 3G-SDI | | | 2 | | |
| | | 6G-SDI | | | 4 | | |
| | Alignment Jitter | SD-SDI | | | 0.2 | | |
| | | HD-SDI | | | 0.2 | | |
| | | 3G-SDI | | | 0.3 | | |
| | | 6G-SDI | | | 0.3 | | |
| Data Input Swing Differential | | $V_{IN}$ | 400 | | 1800 | mV | 3 |
| 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 | $\lambda c$ | 1260 | | 1580 | nm | |
| Receiver Sensitivity | | | | -14 | dBm | 5 |
| Receiver Overload | | +0.5 | | | dBm | 4 |
| LOS De-Assert | $LOS_D$ | | | -20 | dBm | |
| LOS Assert | $LOS_A$ | -28 | | | dBm | |
| LOS Hysteresis | | 1 | | 4 | dB | |
| Data Output Swing Differential | Vout | 650 | 800 | 1000 | mV | 3 |
| LOS | High | 2.0 | | Vcc | V | |
| | Low | | | 0.8 | V | |

**Notes:**
1. The optical power is launched into SMF.
2. Rise and fall times, 20% to 80%, are measured following a fourth-order Bessel-Thompson filter with a bandwidth of 0.75 x clock frequency corresponding to the serial data rate
3. PECL input, internally AC-coupled and terminated.
4. Internally AC-coupled, minimum input overload power for SMPTE ST 2081-1.
5. The sensitivity and overload specification refers to the input power levels for BER = 1E-12 against both PRBS and pathological patterns at SMPTE 259M, SMPTE 292M and SMPTE 424M rates and ST-2081.
6. UI means one period.

## Timing and Electrical

| Parameter | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Tx Disable Negate Time | t_on | | | 1 | ms |
| Tx Disable Assert Time | t_off | | | 10 | µs |
| Time To Initialize, including Reset of Tx Fault | t_init | | | 300 | ms |
| Tx Fault Assert Time | t_fault | | | 100 | µs |
| Tx Disable To Reset | t_reset | 10 | | | µs |
| LOS Assert Time | t_loss_on | | | 100 | µs |
| LOS De-assert Time | t_loss_off | | | 100 | µs |
| Serial ID Clock Rate | f_serial_clock | | 100 | | KHz |
| MOD_DEF (0:2)-High | $V_H$ | 2 | | Vcc | V |
| MOD_DEF (0:2)-Low | $V_L$ | | | 0.8 | V |

## Diagnostics Specification

| Parameter | Range | Unit | Accuracy | Calibration |
|---|---|---|---|---|
| Temperature | 0 to +70 | °C | ±3°C | Internal / External |
| Voltage | 3.0 to 3.6 | V | ±3% | Internal / External |
| Bias Current | 0 to 100 | mA | ±10% | Internal / External |
| TX Power | -5 to -2 | dBm | ±3dB | Internal / External |
| RX Power | -14 to -5 | dBm | ±3dB | Internal / External |

## I2C Bus Interface

    The I2C bus interface uses the 2-wire serial CMOS E2PROM protocol. The serial interface meets the following specifications:
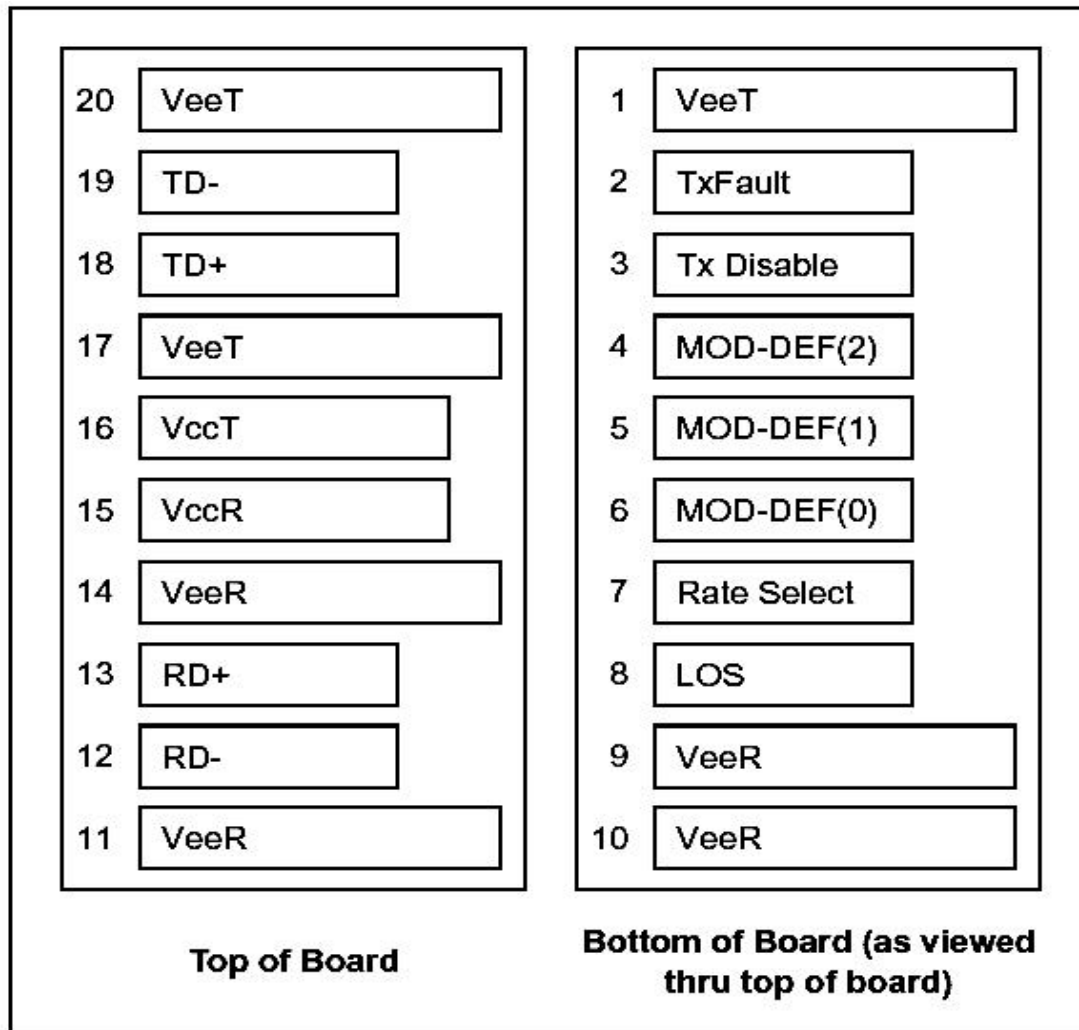
    1.Support a maximum clock rate of 280Khz.

    2. Input/Output levels comply with LVCMOS/LVTTL or compatible logics.

    Low: 0 – 0.8 V

    High: 2.0 – 3.3 V

    Undefined: 0.8 – 2.0 V

## Pin Definitions

| 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 | TxFault |
| 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)**

## Pin Descriptions

| 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 | MOD_DEF(2) | SDA Serial Data Signal | 3 | Note 3 |
| 5 | MOD_DEF(1) | SCL Serial Clock Signal | 3 | Note 3 |
| 6 | MOD_DEF(0) | TTL Low | 3 | Note 3 |
| 7 | Rate Select | Not Connected | 3 | |
| 8 | LOS | Loss of Signal | 3 | Note 4 |

| 9 | V$_{EER}$ | Receiver ground | 1 | |
| 10 | V$_{EER}$ | Receiver ground | 1 | |
| 11 | V$_{EER}$ | Receiver ground | 1 | |
| 12 | RD- | Inv. Received Data Out | 3 | Note 5 |
| 13 | RD+ | Received Data Out | 3 | Note 5 |
| 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 6 |
| 19 | TD- | Inv. Transmit Data In | 3 | Note 6 |
| 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) TX Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k~10kΩ resistor. Its states are:
Low (0 to 0.8V):            Transmitter on
(>0.8V, < 2.0V):            Undefined
High (2.0 to 3.465V):       Transmitter Disabled
Open:                       Transmitter Disabled

3) Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7k~10kΩ 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 is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor. Pull up voltage between 2.0V and Vcc+0.3V. Logic 1 indicates loss of signal; Logic 0 indicates normal operation. In the low state, the output will be pulled to less than 0.8V.

5) 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.

6) TD-/+: These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.

## Mechanical Dimensions
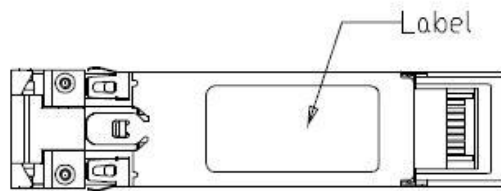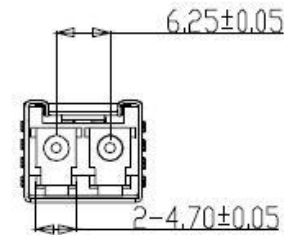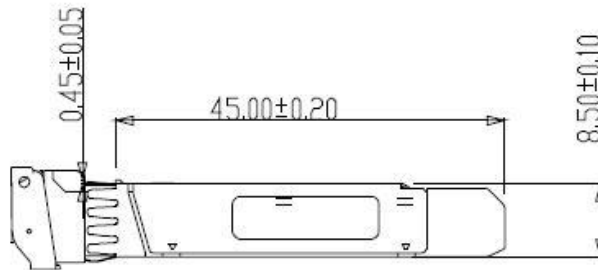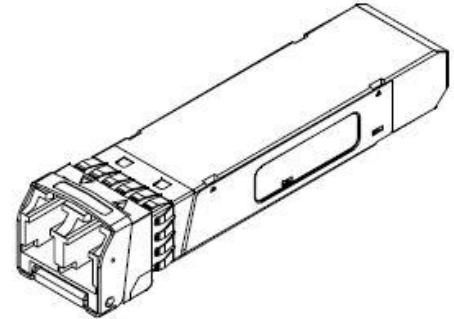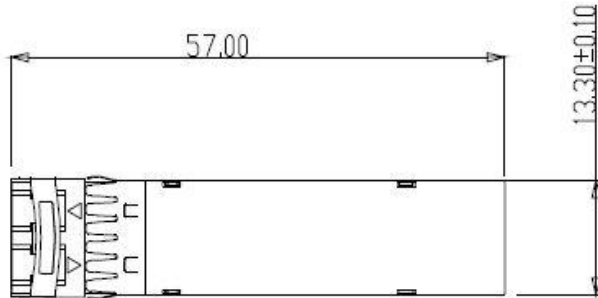
## Ordering information

| Part Number | Product Description |
| --- | --- |
| GHP-316G-L2CD | 1310nm, 6Gbps, 10/20km,   0ºC ~ +70ºC, With Digital Diagnostic Monitoring |

## Important Notice

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