

Professional high-speed optical transceiver

**OPN-S8F1513-20SC / OPN-S8F1513-20SCI /**

**OPN-S8F1513P-20SC / OPN-S8F1513P-20SCI**

**1550 nm TX / 1310 nm RX , 3.3V / 622 Mb/s RoHS Compliant Single-Fiber Transceiver**

## PRODUCT FEATURES

- Single Fiber Bi-Directional Transceiver
  - 1550 nm DFB LD Transmitter
    - 1310 nm Receiver
    - Distance up to 20 km
  - Industry Standard 1 x 9 Footprint
    - Single +3.3 V Power Supply
    - Speed up to 650 Mb/s
    - RoHS Compliant
  - PECL Differential Inputs and Outputs
    - 0 to 70°C Operating Temperature: OPN-S8F1513P-20SC
    - -50 to 85°C Operating Temperature: OPN-S8F1513P-20SCI
      - Wave Solderable
- Class 1 Laser International Safety Standard IEC-60825Compliant

## APPLICATIONS

- WDM 622 Mb/s Links
- SONET / SDH Equipment Interconnect

## PRODUCT DESCRIPTION

The OPN-S8F1513P-20SC series are high performance modules for single fiber communications by using 1550 nm DFB LD transmitter and 1310 nm receiver. The transmitter section uses a multiple quantum well laser and is a class 1 laser compliant according to International Safety StandardIEC-60825. The receiver section uses an integrated 1310 nm detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC. A PECL logic interface simplifies interface to external circuitry.

## ORDER INFORMATION

| P/No.              | Bit Rate (Mb/s) | Distance (km) | TX (nm)  | RX (nm) | Voltage(V) | Package | Temp. (°C) | TX Power (dBm) | RX Sens. (dBm) | RoHS Compliant |
|--------------------|-----------------|---------------|----------|---------|------------|---------|------------|----------------|----------------|----------------|
| OPN-S8F1513P-20SC  | 622             | 20            | 1550 DFB | 1310    | 3.3        | 1X9     | 0 to 70    | -8 to -14      | -28            | Yes            |
| OPN-S8F1513P-20SCI | 622             | 20            | 1550 DFB | 1310    | 3.3        | 1X9     | -50 to 85  | -8 to -14      | -28            | Yes            |

### Absolute Maximum Ratings

| Parameter             | Symbol | Min | Max | Units | Notes                    |
|-----------------------|--------|-----|-----|-------|--------------------------|
| Storage Temperature   | Tstg   | -50 | 85  | °C    |                          |
| Operating Temperature | Topr   | 0   | 70  | °C    | OPN-S8F1513P-20SC        |
|                       |        | -50 | 85  |       | OPN-S8F1513P-20SCI       |
| Soldering Temperature | ---    |     | 250 | °C    | 10 seconds on leads only |
| Power Supply Voltage  | Vcc    | 0   | 3.6 | V     |                          |
| Input Voltage         | ---    | GND | Vcc | V     |                          |
| Output Current        | Iout   | 0   | 30  | mA    |                          |

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| Recommended Operating Conditions |                  |          |     |          |                                                   |
|----------------------------------|------------------|----------|-----|----------|---------------------------------------------------|
| Parameter                        | Symbol           | Min      | Typ | Max      | Units / Notes                                     |
| Power Supply Voltage             | V <sub>CC</sub>  | 3.13     | 3.3 | 3.47     | V                                                 |
| Operating Temperature            | T <sub>opr</sub> | 0<br>-50 |     | 70<br>85 | °C / OPN-S8F1513P-20SC<br>°C / OPN-S8F1513P-20SCI |
| Data Rate                        |                  | 50       | 622 | 650      | Mb/s                                              |
| Power Supply Current             | I <sub>CC</sub>  |          |     | 260      | mA                                                |

| Transmitter Specifications (0°C < T <sub>opr</sub> < 70°C, 3.13V < V <sub>CC</sub> < 3.47V) |                                                                  |      |     |       |       |                   |
|---------------------------------------------------------------------------------------------|------------------------------------------------------------------|------|-----|-------|-------|-------------------|
| Parameter                                                                                   | Symbol                                                           | Min  | Typ | Max   | Units | Notes             |
| <b>Optical</b>                                                                              |                                                                  |      |     |       |       |                   |
| Optical Transmit Power                                                                      | P <sub>o</sub>                                                   | -14  | --- | -8    | dBm   | 1                 |
| Output Center Wavelength                                                                    | $\lambda$                                                        | 1480 |     | 1580  | nm    |                   |
| Output Spectrum Width                                                                       | $\Delta\lambda$                                                  | ---  | --- | 1     | nm    | -20 dB Width      |
| Extinction Ratio                                                                            | E <sub>R</sub>                                                   | 8.2  | --- | ---   | dB    |                   |
| Output Eye                                                                                  | Compliant with Bellcore GR-253-CORE and ITU recommendation G.957 |      |     |       |       |                   |
| Optical Rise Time                                                                           | t <sub>r</sub>                                                   |      |     | 1.2   | ns    | 10% to 90% Values |
| Optical Fall Time                                                                           | t <sub>f</sub>                                                   |      |     | 1.2   | ns    | 10% to 90% Values |
| Relative Intensity Noise                                                                    | RIN                                                              |      |     | -116  | dB/Hz |                   |
| Total Jitter                                                                                | TJ                                                               |      |     | 0.55  | ns    | 2                 |
| <b>Electrical</b>                                                                           |                                                                  |      |     |       |       |                   |
| Data Input Current – Low                                                                    | I <sub>IL</sub>                                                  | -350 |     |       | μA    |                   |
| Data Input Current – High                                                                   | I <sub>IH</sub>                                                  |      |     | 350   | μA    |                   |
| Differential Input Voltage                                                                  | V <sub>IH</sub> - V <sub>IL</sub>                                | 300  |     |       | mV    |                   |
| Data Input Voltage – Low                                                                    | V <sub>IL</sub> - V <sub>CC</sub>                                | -2.0 |     | -1.58 | V     | 3                 |
| Data Input Voltage -- High                                                                  | V <sub>IH</sub> - V <sub>CC</sub>                                | -1.1 |     | -0.74 | V     | 3                 |

- Notes: 1. Output power is power coupled into a 9/125 μm single mode fiber.  
 2. Measured with a 2<sup>23</sup>-1 PRBS with 72 ones and 72 zeros.  
 3. These inputs are compatible with 10K, 10KH and 100K ECL and PECL inputs.

| Receiver Specifications (0°C < T <sub>opr</sub> < 70°C, 3.13V < V <sub>CC</sub> < 3.47V) |                                   |      |     |       |       |                         |
|------------------------------------------------------------------------------------------|-----------------------------------|------|-----|-------|-------|-------------------------|
| Parameter                                                                                | Symbol                            | Min  | Typ | Max   | Units | Notes                   |
| <b>Optical</b>                                                                           |                                   |      |     |       |       |                         |
| Sensitivity                                                                              | ---                               | ---  | --- | -28   | dBm   | 1                       |
| Maximum Input Power                                                                      | P <sub>in</sub>                   | -8   |     | ---   | dBm   |                         |
| Signal Detect -- Asserted                                                                | P <sub>a</sub>                    | ---  | --- | -28   | dBm   | Transition: low to high |
| Signal Detect -- Deasserted                                                              | P <sub>d</sub>                    | -38  | --- | ---   | dBm   | Transition: high to low |
| Signal detect -- Hysteresis                                                              |                                   | 1.0  | --- |       | dB    |                         |
| Wavelength of Operation                                                                  |                                   | 1260 | --- | 1360  | nm    | 2                       |
| <b>Electrical</b>                                                                        |                                   |      |     |       |       |                         |
| Data Output Voltage – Low                                                                | V <sub>OL</sub> - V <sub>CC</sub> | -2.0 |     | -1.58 | V     | 3                       |
| Data Output Voltage – High                                                               | V <sub>OH</sub> - V <sub>CC</sub> | -1.1 |     | -0.74 | V     | 3                       |
| SD Output Voltage -- Low                                                                 | V <sub>OL</sub> - V <sub>CC</sub> | -2.0 |     | -1.58 | V     | 3                       |
| SD Output Voltage -- High                                                                | V <sub>OH</sub> - V <sub>CC</sub> | -1.1 |     | -0.74 | V     | 3                       |

- Notes: 1. Minimum sensitivity and saturation levels at BER=1E-10 for a 2<sup>23</sup>-1 PRBS with 72 ones and 72 zeros.  
 2. At least 30 dB optical isolation for the wavelength 1480 to 1580 nm.  
 3. These outputs are compatible with 10K, 10KH and 100K ECL and PECL outputs.

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### CONNECTION DIAGRAM

Receiver Signal Ground  
Receiver Data Out  
Receiver Data Out Bar  
Signal Detect  
Receiver Power Supply  
Transmitter Power Supply  
Transmitter Data In Bar  
Transmitter Data In  
Transmitter Signal Ground

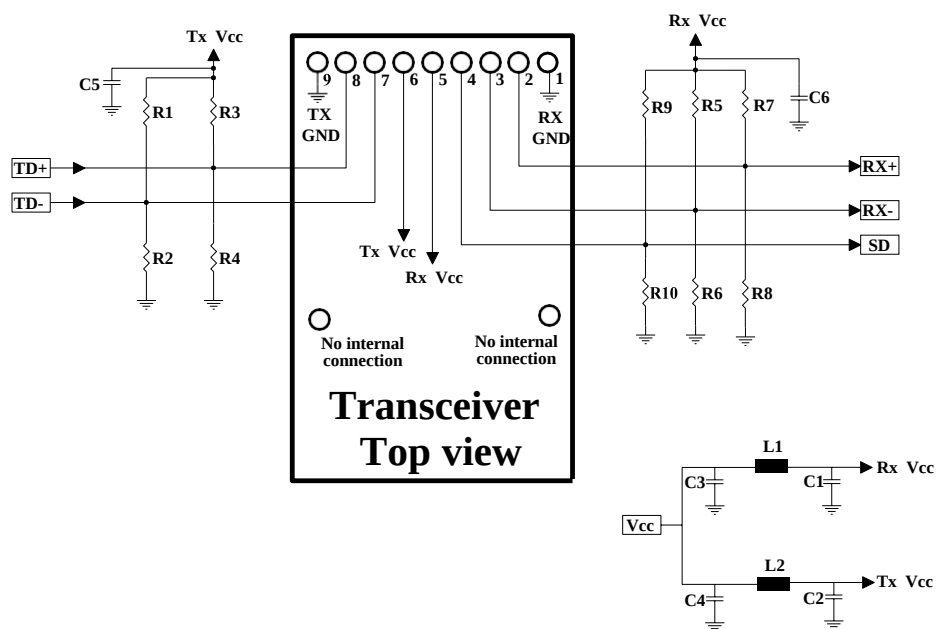
1 (Rx GND)  
2 (RD+)  
3 (RD-)  
4 (SD)  
5 (Rx Vcc)  
6 (Tx Vcc)  
7 (TD-)  
8 (TD+)  
9 (Tx GND)

TOP VIEW

○  
N/C  
○  
N/C  
○

| PIN | Symbol | Notes                                                     |
|-----|--------|-----------------------------------------------------------|
| 1   | Rx GND | Directly connect this pin to the receiver ground plane    |
| 2   | RD+    | See recommended circuit schematic                         |
| 3   | RD-    | See recommended circuit schematic                         |
| 4   | SD     | Active high on this indicates a received optical signal   |
| 5   | Rx Vcc | +3.3V dc power for the receiver section                   |
| 6   | Tx Vcc | +3.3V dc power for the transmitter section                |
| 7   | TD-    | See recommended circuit schematic                         |
| 8   | TD+    | See recommended circuit schematic                         |
| 9   | Tx GND | Directly connect this pin to the transmitter ground plane |

### RECOMMENDED CIRCUIT SCHEMATIC



R1=R3=R5=R7=R9=130 ohm  
R2=R4=R6=R8=R10=82 ohm  
C1=C2=C3=C5=C6=0.1 uF  
C4=10uF L1=L2=1uH

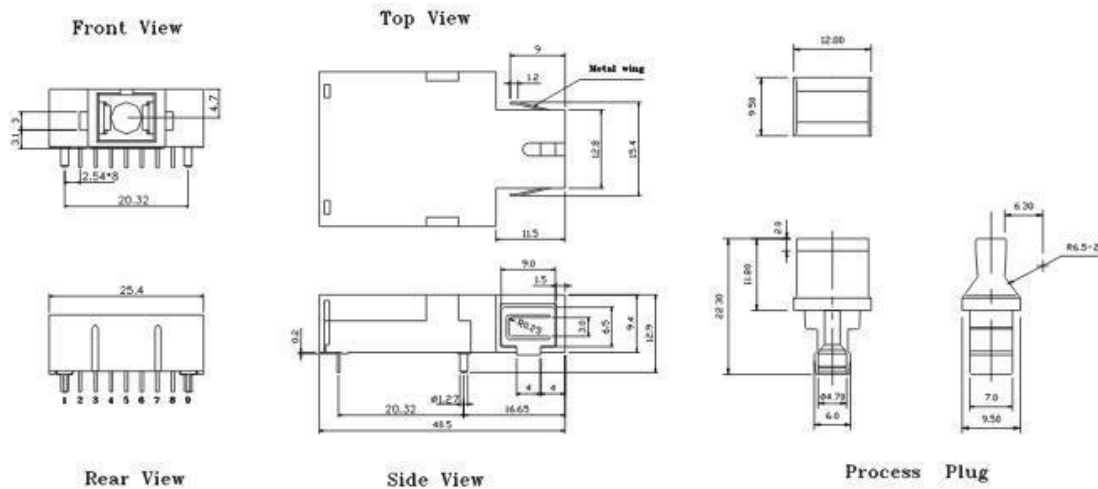
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The split-load terminations for ECL signals need to be located at the input of devices receiving those ECL signals. The power supply filtering is required for good EMI performance. Use short tracks from the inductor L1/L2 to the module Rx Vcc and Tx Vcc. A GND plane under the module is required for good EMI and sensitivity performance.

### PACKAGE DIAGRAM

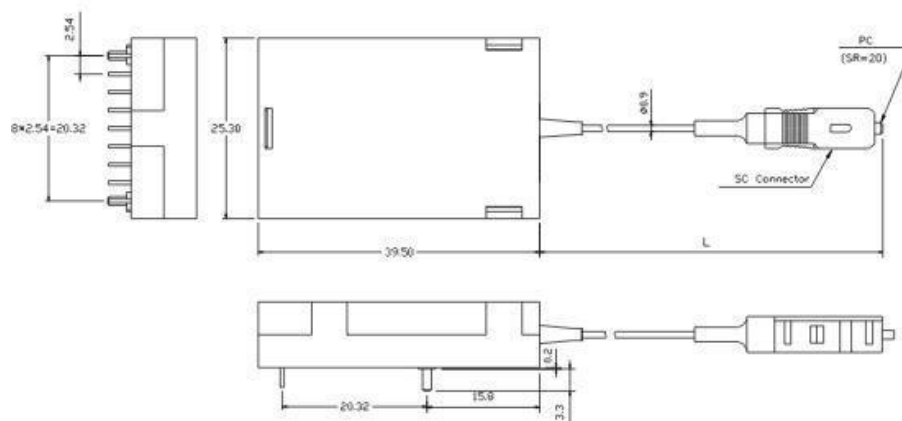
Units in mm

#### 1) Receptacle Type



#### OPN-S8F1513-20SC / OPN-S8F1513-20SCI

#### 2) Pigtail Type



#### OPN-S8F1513P-20SC / OPN-S8F1513P-20SCI

**Note:** Length L is  $50 \pm 3$  cm. Other pigtail's length is available upon request.

**Note:** Specifications subject to change without notice.