

## Professional high-speed optical transceiver

**OPN-S8G139-5D19SC / OPN-S8G139-5D19SC**  
**OPN-S8G139-5D19SC-EMG / OPN-S8G139-5D19SC-EMG**  
**OPN-S8G139-5D19ST / OPN-S8G139-5D19ST**  
**OPN-S8G139-5D19FC / OPN-S8G139-5D19FC**

**CWDM 5V / 1.25 Gbps RoHS Compliant Optical Single-Mode Transceiver**

## PRODUCT FEATURES

- Duplex SC SM Transceiver: OPN-S8G139-5D19SC
- Duplex ST SM Transceiver: OPN-S8G139-5D19ST
- Duplex FC SM Transceiver: OPN-S8G139-5D19FC
  - Compliant with IEEE 802.3z Gigabit Ethernet
- 18-Wavelength CWDM DFB LD Transmitter from 1270 nm to 1610 nm, with step 20 nm
  - 19 dB Link Budget at Least
  - Industry Standard 1 x 9 Footprint
    - Single +5 V Power Supply
    - RoHS Compliant
  - PECL Signal Detect Output: OPN-S8G139-5D19FC
  - TTL Signal Detect Output: OPN-S8G139T-5D19FC
    - Wave Solderable
- Class 1 Laser International Safety Standard IEC 60825 Compliant

## APPLICATIONS

- Gigabit Ethernet Links
- SONET / SDH Equipment Interconnect
  - Fibre Channel Links
  - CWDM

## PRODUCT DESCRIPTION

The OPN-S8G139-5D19FC series single mode transceiver is a low power, high performance CWDM module for bi-directional serial optical data communications such as Gigabit Ethernet and Fibre Channel. There are eighteen center wavelengths available from 1270 nm to 1610 nm, each step 20 nm. A guaranteed minimum optical link budget of 19 dB is offered. The transmitter section uses a multiple quantum well DFB laser and is a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated InGaAs 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<br>(Mb/s) | 1000<br>BASE | Power<br>Budget<br>(dB) | Wavelength<br>(nm) | Voltage<br>(V) | Package      | Temp.<br>(°C) | TX<br>Power<br>(dBm) | RX<br>Sens.<br>(dBm) | RoHS<br>Compliant |
|-------------------|--------------------|--------------|-------------------------|--------------------|----------------|--------------|---------------|----------------------|----------------------|-------------------|
| OPN-S8G139-5D19FC | 1250               | ZX           | > 19                    | CWDM*              | 5              | 1X9 SC/ST/FC | 0 to 70       | 0 to -5              | -24                  | Y                 |

### CWDM Wavelength (0 to 70°C)

| Central<br>Wavelength | Min.<br>(nm) | Typ.<br>(nm) | Max.<br>(nm) | Central<br>Wavelength | Min.<br>(nm) | Typ.<br>(nm) | Max.<br>(nm) |
|-----------------------|--------------|--------------|--------------|-----------------------|--------------|--------------|--------------|
| 127                   | 1264.5       | 1270         | 1277.5       | 145                   | 1444.5       | 1450         | 1457.5       |
| 129                   | 1284.5       | 1290         | 1297.5       | 147                   | 1464.5       | 1470         | 1477.5       |

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|     |        |      |        |     |        |      |        |
|-----|--------|------|--------|-----|--------|------|--------|
| 131 | 1304.5 | 1310 | 1317.5 | 149 | 1484.5 | 1490 | 1497.5 |
| 133 | 1324.5 | 1330 | 1337.5 | 151 | 1504.5 | 1510 | 1517.5 |
| 135 | 1344.5 | 1350 | 1357.5 | 153 | 1524.5 | 1530 | 1537.5 |
| 137 | 1364.5 | 1370 | 1377.5 | 155 | 1544.5 | 1550 | 1557.5 |
| 139 | 1384.5 | 1390 | 1397.5 | 157 | 1564.5 | 1570 | 1577.5 |
| 141 | 1404.5 | 1410 | 1417.5 | 159 | 1584.5 | 1590 | 1597.5 |
| 143 | 1424.5 | 1430 | 1437.5 | 161 | 1604.5 | 1610 | 1617.5 |

CWDM\*: 18 Wavelengths from 1270 nm to 1610 nm, each step 20 nm.

### Absolute Maximum Ratings

| Parameter             | Symbol | Min | Max | Units | Notes                    |
|-----------------------|--------|-----|-----|-------|--------------------------|
| Storage Temperature   | Tstg   | -50 | 85  | °C    |                          |
| Operating Temperature | Topr   | 0   | 70  | °C    | With air flow 1m/sec     |
| Soldering Temperature | ---    |     | 260 | °C    | 10 seconds on leads only |
| Power Supply Voltage  | Vcc    | 0   | 5.5 | V     |                          |
| Input Voltage         | ---    | GND | Vcc | V     |                          |
| Output Current        | Iout   | 0   | 30  | mA    |                          |

### Recommended Operating Conditions

| Parameter             | Symbol | Min  | Typ  | Max  | Units                |
|-----------------------|--------|------|------|------|----------------------|
| Power Supply Voltage  | Vcc    | 4.75 | 5    | 5.25 | V                    |
| Operating Temperature | Topr   | 0    |      | 70   | °C / air flow 1m/sec |
| Data Rate             |        |      | 1250 | 1300 | Mb/s                 |
| Power Supply Current  | Icc    |      | 200  | 280  | mA                   |

### Transmitter Specifications (0°C < Topr < 70°C, 4.75V < Vcc < 5.25V)

| Parameter                   | Symbol                                                             | Min           | Typ       | Max           | Units | Notes             |
|-----------------------------|--------------------------------------------------------------------|---------------|-----------|---------------|-------|-------------------|
| <b>Optical</b>              |                                                                    |               |           |               |       |                   |
| Optical Transmit Power      | Po                                                                 | -5            | ---       | 0             | dBm   | 1                 |
| Output Center Wavelength    | $\lambda$                                                          | $\lambda-5.5$ | $\lambda$ | $\lambda+7.5$ | nm    | 2                 |
| Output Spectrum Width       | $\Delta\lambda$                                                    | ---           | ---       | 1             | nm    | -20 dB Width      |
| Side Mode Suppression Ratio | SMSR                                                               | 30            |           |               | dB    |                   |
| Extinction Ratio            | ER                                                                 | 9             | ---       | ---           | dB    |                   |
| Output Eye                  | Compliant with Bellcore TR-NWT-000253 and ITU recommendation G.957 |               |           |               |       |                   |
| Optical Rise Time           | t <sub>r</sub>                                                     |               |           | 0.26          | ns    | 20% to 80% Values |
| Optical Fall Time           | t <sub>f</sub>                                                     |               |           | 0.26          | ns    | 20% to 80% Values |
| Relative Intensity Noise    | RIN                                                                |               |           | -120          | dB/Hz |                   |
| Total Jitter                | TJ                                                                 |               |           | 0.227         | ns    | 3                 |
| <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     | 4                 |
| Data Input Voltage -- High  | V <sub>IH</sub> - V <sub>CC</sub>                                  | -1.1          |           | -0.74         | V     | 4                 |

Notes: 1. Output power is power coupled into a 9/125 μm single mode fiber.

2. ITU-T G.694.2 CWDM wavelength from 1270 nm to 1610 nm, each step 20 nm.

3. Measured with a 2<sup>7</sup>-1 PRBS.

4. These inputs are compatible with 10K, 10KH and 100K ECL and LVPECL inputs.

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| Receiver Specifications (0°C < Topr < 70°C, 4.75V < Vcc < 5.25V) |                                   |      |     |       |       |                         |
|------------------------------------------------------------------|-----------------------------------|------|-----|-------|-------|-------------------------|
| Parameter                                                        | Symbol                            | Min  | Typ | Max   | Units | Notes                   |
| <b>Optical</b>                                                   |                                   |      |     |       |       |                         |
| Sensitivity                                                      | ---                               | ---  | --- | -24   | dBm   | 1                       |
| Maximum Input Power                                              | Pin                               | -3   |     | ---   | dBm   |                         |
| Signal Detect -- Asserted                                        | Pa                                | ---  | --- | -24   | dBm   | Transition: low to high |
| Signal Detect -- Deasserted                                      | Pd                                | -36  | --- | ---   | dBm   | Transition: high to low |
| Signal detect -- Hysteresis                                      |                                   | 1.0  | --- |       | dB    |                         |
| Wavelength of Operation                                          |                                   | 1100 | --- | 1620  | nm    |                         |
| <b>Electrical</b>                                                |                                   |      |     |       |       |                         |
| Data Output Voltage -- Low                                       | V <sub>OL</sub> - V <sub>CC</sub> | -2.0 |     | -1.58 | V     | 2                       |
| Data Output Voltage -- High                                      | V <sub>OH</sub> - V <sub>CC</sub> | -1.1 |     | -0.74 | V     | 2                       |
| Signal Detect Output Voltage -- Low                              | V <sub>OL</sub> - V <sub>CC</sub> | -2.0 |     | -1.58 | V     | OPN-S8G139-5D19FC       |
| Signal Detect Output Voltage -- High                             | V <sub>OH</sub> - V <sub>CC</sub> | -1.1 |     | -0.74 | V     |                         |
| Signal Detect Output Voltage -- Low                              | V <sub>SDL</sub>                  |      |     | 0.5   | V     | OPN-S8G139T-5D19FC      |
| Signal Detect Output Voltage -- High                             | V <sub>SDH</sub>                  | 2.0  |     |       | V     |                         |

Notes: 1. Minimum sensitivity and saturation levels at BER=1E-12 for a 2<sup>7</sup>-1 PRBS at ER=9 dB.

2. These outputs are compatible with 10K, 10KH and 100K ECL and PECL outputs.

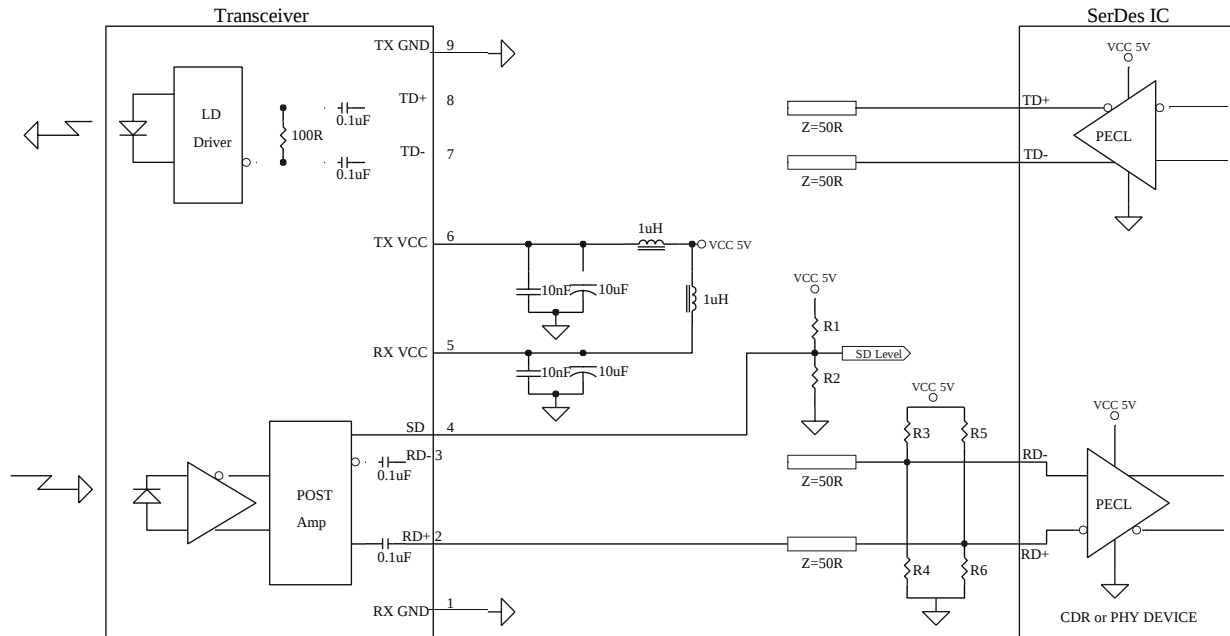
## CONNECTION DIAGRAM

|                           |            |          |     |
|---------------------------|------------|----------|-----|
| Receiver Signal Ground    | 1 (Rx GND) |          | ○   |
| Receiver Data Out         | 2 (RD+)    |          | N/C |
| Receiver Data Out Bar     | 3 (RD-)    |          |     |
| Signal Detect             | 4 (SD)     |          |     |
| Receiver Power Supply     | 5 (Rx Vcc) | TOP VIEW |     |
| Transmitter Power Supply  | 6 (Tx Vcc) |          |     |
| Transmitter Data In Bar   | 7 (TD-)    |          |     |
| Transmitter Data In       | 8 (TD+)    |          | N/C |
| Transmitter Signal Ground | 9 (Tx GND) |          | ○   |

| 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 | +5V dc power for the receiver section                     |
| 6   | Tx Vcc | +5V 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 |

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### RECOMMENDED CIRCUIT SCHEMATIC



For TTL SD Level, R1=R2=N.C., R3=R5=82R, R4=R6=130R

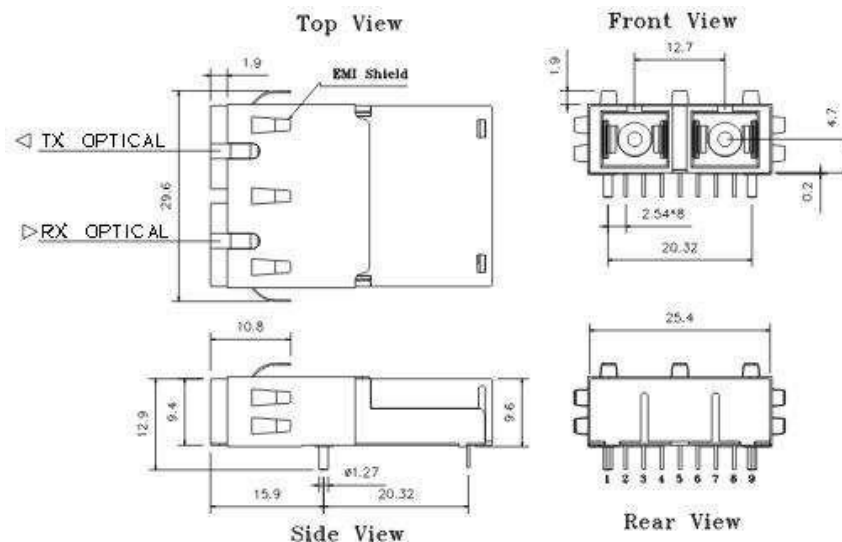
For PECL SD Level, R1=R3=R5=82R, R2=R4=R6=130R

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) SC Type With Extended Shielding



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