

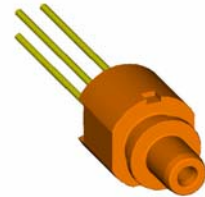
Product Specification

2.5Gbps 850nm VCSEL, LC TOSA

HFE4190-441, HFE4191-441

PRODUCT FEATURES

- 850nm multi-mode oxide isolated VCSEL
- Extended Temperature Range Operation (– 40 to +85 deg operating range)
- Capable of modulation operation from DC to 2.5Gbps
- TO-46 tilt window metal can component, prealigned into LC Sleeve
- Designed for drive currents between 3-15mA average
- Packaged with a back monitor
- Attenuated window can



These products are high-performance 850nm VCSELs (Vertical Cavity Surface-Emitting Lasers) designed for high-speed data communications and packaged with a custom designed power monitor diode. The power monitor diode can be used with appropriate feedback control circuitry to set a maximum power level for the VCSEL. These combined features simplify design for high data rate communication and eye safety.

These products are designed to be used with inexpensive silicon or gallium arsenide detectors, but excellent performance can also be achieved with some indium gallium arsenide detectors (see HFD3180-103 and HFD3180-108 product data sheets).

VCSELs produce circularly symmetric, non-astigmatic, narrow divergence beams that, with appropriate lensing, fiber couple all of the emitter power. These LC TOSA products are pre-aligned and focused fiber optic transmitters designed to interface with 50/125 and 62.5/125 μ m multi-mode fiber

PRODUCT SELECTION

| Part Number | Description |
|-------------|--|
| HFE4190-441 | LC TOSA with attenuated TO-46 component, VCSEL with Back Monitor Photodiode, Anode of VCSEL common with Photodiode Cathode |
| HFE4191-441 | LC TOSA with attenuated TO-46 component, VCSEL with Back Monitor Photodiode, Cathode of VCSEL common with Photodiode Anode |

I. Absolute Maximum Ratings

| Parameter | Rating |
|---|-------------------|
| Storage Temperature | -40 to +85°C |
| Case Operating Temperature | -40* to +85°C |
| Lead Solder Temperature | 260°C, 10 sec. |
| Laser continuous average current | 12mA |
| Laser peak forward current with pulse width less than 1us | 18mA |
| Laser reverse voltage | 5V |
| ESD Exposure (Human Body Model) | 225V ¹ |

¹Heel and wrist straps must be used on a properly grounded workstation



Notice

Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operations section for extended periods of time may affect reliability.

Notice

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation to equipment, take normal ESD precautions when handling this product

II. Electro-Optical Characteristics

| VCSEL Parameters | Test Condition | Symbol | Min. | Typ. | Max. | Units | Notes |
|---|---|----------------------------|------|----------|------------|----------|-------|
| Average Fiber Coupled Power | $I_F = 7\text{mA}$ | P_{OC} | | 0.500 | | mW | 2 |
| Minimum coupling efficiency including wiggle | $I_F = 7\text{mA}$ | | 55 | | | % | 2 |
| Threshold Current | | I_{TH} | 0.5 | 1.8 | 2.5 | mA | |
| Threshold Current maximum deviation from 25°C value | $T_A = 0^\circ\text{C}$ to 70°C | ΔI_{TH} | -0.5 | | 1 | mA | 3 |
| | $T_A = 25^\circ\text{C}$ to 85°C | ΔI_{TH} | | | 1.7 | mA | 3 |
| | $T_A = -40^\circ\text{C}$ to 25°C | ΔI_{TH} | | | 2.5 | mA | 3 |
| Temperature at minimum threshold current | | T_O | -20 | | 50 | °C | 3 |
| Slope Efficiency | $T_A = 25^\circ\text{C}$ | η | 0.04 | 0.125 | 0.16 | mW/mA | 4 |
| | $T_A = -40^\circ\text{C}$ | η | | | 0.200 | mW/mA | |
| | $T_A = 85^\circ\text{C}$ | η | 0.03 | | | mW/mA | |
| Slope Efficiency Temperature variation | $T_A = 0^\circ\text{C}$ to 70°C | $\Delta\eta/\Delta T$ | | -6000 | | ppm/°C | 5 |
| Peak Wavelength | $I_F = 7\text{mA}$, $T_A = 0^\circ\text{C}$ to 85°C | λ_P | 830 | 850 | 860 | nm | |
| λ_P Temperature Variation | $I_F = 7\text{mA}$, $T_A = -40^\circ\text{C}$ to 85°C | $\Delta\lambda_P/\Delta T$ | | 0.06 | | nm/°C | |
| Spectral Bandwidth, RMS | $I_F = 7\text{mA}$ | $\Delta\lambda$ | | | 0.65 | nm | |
| Laser Forward Voltage | $I_F = 7\text{mA}$ | V_F | | 1.8 | 2.0 | V | |
| Rise and Fall Times | $P_{avg} = 0.625\text{mW}$, Extinction Ratio = 10 | t_r t_f | | | 130 150 | ps | 6 |
| Relative Intensity Noise | 1 GHz BW, $I_F = 7\text{mA}$ | RIN | | -130 | -122 | dB/Hz | |
| Series Resistance | $I_F = 7\text{mA}$, $T_A = 25^\circ\text{C}$ | R_S | 25 | 35 | 50 | Ω | |
| | $T_A = -40^\circ\text{C}$ | R_S | | | 60 | Ω | |
| | $T_A = 85^\circ\text{C}$ | R_S | 20 | | | Ω | |
| Series Resistance Temperature Coefficient | $I_F = 7\text{mA}$, $T_A = 0^\circ\text{C}$ to 70°C | $\Delta R_S/\Delta T$ | | -3000 | | ppm/°C | 7 |
| Photodiode Parameters | Test Condition | Symbol | Min. | Typ. | Max. | Units | Notes |
| Monitor Current | $P_{oc} = 0.5\text{mW}$, $T_A = 25^\circ\text{C}$ | I_{PD} | 0.1 | | 0.6 | mA | |
| | $P_{oc} = 0.5\text{mW}$, $T_A = -40^\circ\text{C}$ | I_{PD} | TBD | | TBD | | |
| | $P_{oc} = 0.5\text{mW}$, $T_A = +85^\circ\text{C}$ | I_{PD} | TBD | | TBD | mA | |
| Monitor current Temperature Variation | $P_{oc} = 0.5\text{mW}$, 0°C to 70°C | $\Delta I_{PD}/\Delta T$ | | TBD | | %/°C | |
| Monitor Current Tracking | | ΔI_{trk} | | TBD | | | 8 |
| Dark Current | $P_o = 0\text{mW}$, $V_R = 3\text{V}$ | I_D | | | 20 | nA | |
| PD Capacitance | $V_R = 0\text{V}$, Freq = 1MHz $V_R = 3\text{V}$, Freq = 1MHz | C | | 75 40 | 100 55 | pF | |

Notes:

1. Reliability is a function of temperature, see www.finisar.com for details.
2. For the purpose of these tests, I_F is DC current.
3. Threshold current varies as $(T_A - T_O)^2$. It may either increase or decrease with temperature, depending upon relationship of T_A to T_O . The magnitude of the change is proportional to the threshold at T_O .
4. Slope efficiency is defined as $\Delta P_O / \Delta I_F$.
5. To compute the value of Slope Efficiency at a temperature T, use the following equation:

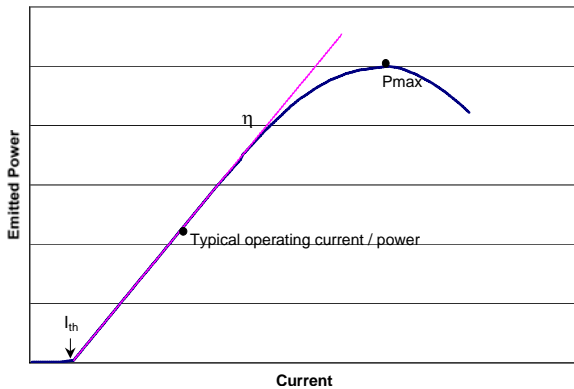
$$\eta(T) \approx \eta(25^\circ\text{C}) * [1 + (\Delta\eta / \Delta T) * (T - 25)]$$
6. Rise and fall times specifications are the 20% - 80%. Most of the devices will measure <135ps fall time. Rise and fall times are sensitive to drive electronics.
7. To compute the value of Series Resistance at a temperature T, use the following equation:

$$R_S(T) \approx R_S(25^\circ\text{C}) * [1 + (\Delta R_S / \Delta T) * (T - 25)]$$
8. Monitor current tracking is defined as follows:

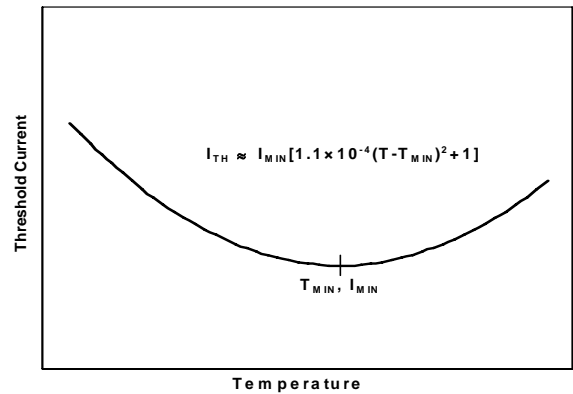
$$\text{Deltrk} = \frac{I_{PD}(P_O = 0.75\text{mW}) / 0.75\text{mW}}{I_{PD}(P_O = 0.45\text{mW}) / 0.45\text{mW}}$$

III. Typical Performance Curves

Emitted Power vs. Current: Power varies approximately linearly with current above threshold.



Threshold Current vs. Temperature: Threshold current varies parabolically with temperature; thus it can be nearly constant for a limited temperature range.



IV. Environmental Specifications

| Parameter | Symbol | Min | Typ | Max | Units | Ref. |
|----------------------------|------------------|------------|------------|------------|--------------|-------------|
| Case Operating Temperature | T _{op} | -40 | | 85 | °C | |
| Storage Temperature | T _{sto} | -40 | | 85 | °C | |

V. Regulatory Compliance

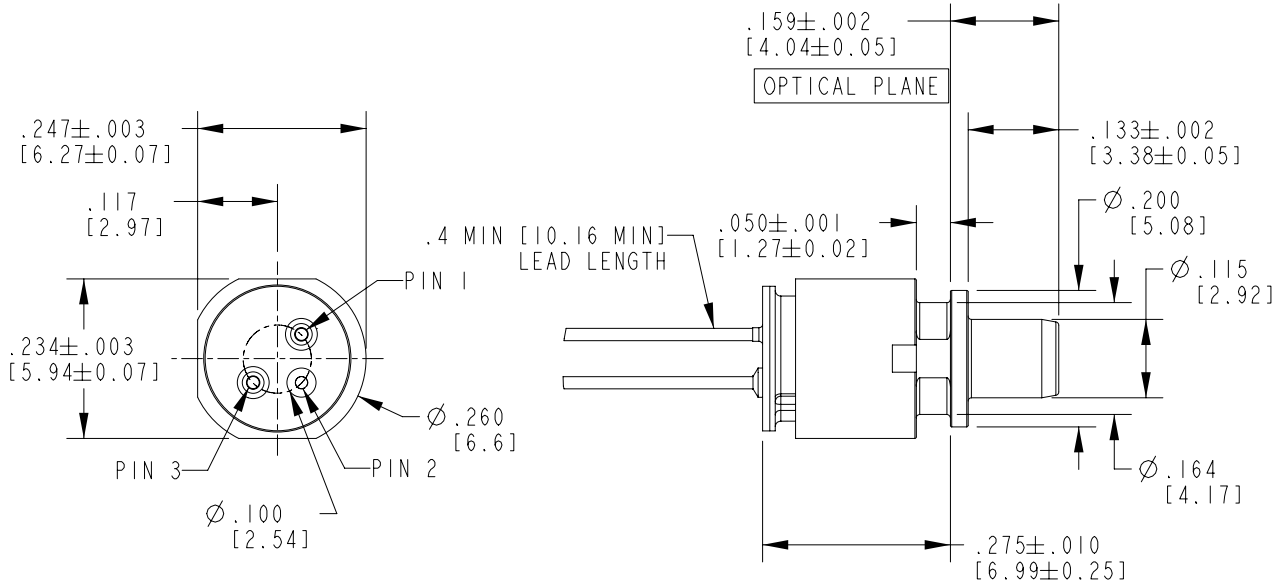
| Feature | Agency | Standard | Certificate Number |
|------------------|---------------|--------------------------------------|---------------------------|
| Laser Eye Safety | FDA/CDRH | CDRH 21 CFR 1040 and Laser Notice 50 | |

Copies of the referenced certificates are available at Finisar Corporation upon request.

VI. Mechanical Specifications

| HFE4190-441 | | HFE4191-441 | |
|-------------|-----------------------------------|-------------|-----------------------------------|
| Number | Function | Number | Function |
| 1 | K _{LD} | 1 | A _{LD} |
| 2 | K _{PD} , A _{LD} | 2 | K _{LD} , A _{PD} |
| 3 | A _{PD} | 3 | K _{PD} |

| | | | |
|-----------------|---------------|-----------------|----------------------------|
| A _{LD} | VCSEL Anode | A _{PD} | Monitor Photodiode Anode |
| K _{LD} | VCSEL Cathode | K _{PD} | Monitor Photodiode Cathode |



(dimensions are in inches [mm])

XI. Revision History

| Revision | Date | Description |
|-----------------|-------------|---------------------|
| A1 | 4/13/2013 | • Document created. |

XII. For More Information

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