

# DATA SHEET

# 1/2/4/8 GBPS 850NM VCSEL LC TOSA PACKAGES

## HFE7192-XXX

### FEATURES:

- LC TOSA HFE7192-x6x includes flex circuit
- LC TOSA HFE7192-x8x leaded package
- High performance VCSEL
- Low electrical parasitic TO package
- Data rates from DC to 8.5Gbps
- Two polarities of Differential versions available
- Complete isolation between the VCSEL and Monitor Photodiode
- Mechanically compatible with SFF, SFP and SFP+ MSAs
- Optional flex circuit interface

The HFE7192-xxx uses a high-performance Vertical Cavity Surface Emitting Laser (VCSEL) designed to meet performance requirements for 1/2/4/8 Gbps data communication over multimode optical fiber for the ANSI X2.T11 Fibre Channel protocols. The optical assembly is designed to interface either 50 $\mu$ m or 62.5 $\mu$ m multimode fiber and ensure launch conditioning requirements compatibility with enhanced bandwidth fiber as specified by TIA 455-203.

The HFE7192-xxx incorporates a power monitoring photodiode that can be used for temperature compensation, average power control, and for compliance with Class 1 eye safety limits.

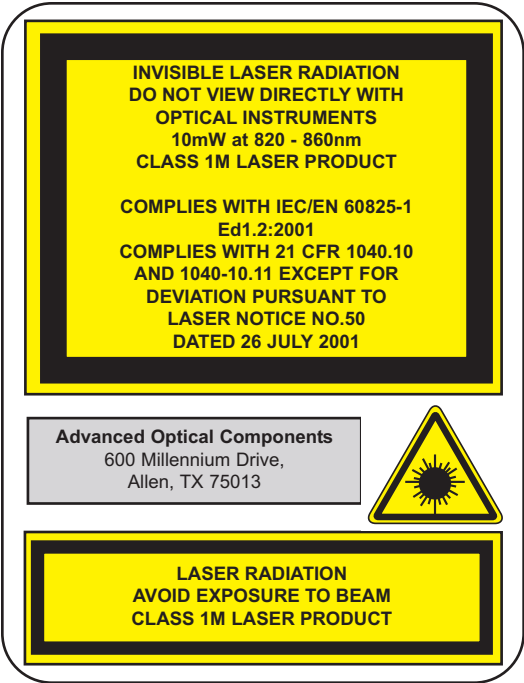


| Part Number | Description                                                                         |
|-------------|-------------------------------------------------------------------------------------|
| HFE7192-581 | Differentially Driven, attenuated, LC TOSA, normal polarity                         |
| HFE7192-681 | Differentially Driven, attenuated, LC TOSA, inverse polarity                        |
| HFE7192-561 | Differentially Driven, attenuated, LC TOSA, normal polarity, with 50 $\Omega$ Flex  |
| HFE7192-661 | Differentially Driven, attenuated, LC TOSA, inverse polarity, with 50 $\Omega$ Flex |

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ABSOLUTE MAXIMUM RATINGS



| Parameter                       | Rating                    |
|---------------------------------|---------------------------|
| Storage temperature             | -40°C to +85°C            |
| Case Operating temperature      | -20 <sup>*</sup> to +85°C |
| Lead solder temperature         | 260°C, 10 seconds         |
| Reverse Power Supply Voltage    | 5V                        |
| Peak continuous forward current | 12mA                      |
| ESD Exposure (Human Body Model) | 225V <sup>1</sup>         |

<sup>\*</sup> -20°C operation under assessment.

<sup>1</sup> Heel 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.

## ELECTRICAL-OPTICAL CHARACTERISTICS

T<sub>A</sub> = 25°C unless otherwise stated

| VCSEL Parameters                        | Test Condition                                 | Symbol              | Min.  | Typ. | Max.  | Units | Notes |
|-----------------------------------------|------------------------------------------------|---------------------|-------|------|-------|-------|-------|
| Fiber coupled optical power             | I <sub>F</sub> = 6.7mA peak<br>50/125μm fiber  | P <sub>OC</sub>     | 360   | 470  |       | μW    |       |
| Coupling Efficiency including wiggles   | I <sub>F</sub> = 6.7mA                         | PO_PCT              | 65    |      |       | %     | 1     |
| Threshold Current                       | T <sub>A</sub> =25°C                           | I <sub>TH</sub>     |       | 1    | 1.5   | mA    |       |
| Threshold Current Temperature Variation | T <sub>A</sub> = -5° to 85°C                   | ΔI <sub>TH</sub>    |       |      | 1.5   | mA    | 2     |
|                                         | T <sub>A</sub> = 25° to 85°C                   |                     |       |      | 1.5   |       |       |
|                                         | T <sub>A</sub> = -5° to 25°C                   |                     |       |      | 1.0   |       |       |
| Slope Efficiency                        | T <sub>A</sub> = 25°C, P <sub>OC</sub> =0.47mW | η                   | 0.065 | 0.08 | 0.105 | mW/mA | 3     |
|                                         | T <sub>A</sub> = 85°C, P <sub>OC</sub> =0.47mW |                     | 0.015 |      |       |       |       |
|                                         | T <sub>A</sub> = -5°C, P <sub>OC</sub> =0.47mW |                     |       |      | 0.12  |       |       |
| Slope Efficiency Temperature Variation  | T <sub>A</sub> =-5 to 85°C                     | Δη/ΔT               |       | -0.4 |       | %/°C  |       |
| Optical Modulation Amplitude            |                                                | P <sub>OMA</sub>    | 480   |      |       |       | 9     |
| Peak Wavelength                         | I <sub>F</sub> =6.7mA                          | λ <sub>p</sub>      | 840   |      | 860   | nm    |       |
| λ <sub>p</sub> Temperature Variation    | T <sub>A</sub> =-5 to 85°C                     | Δλ <sub>p</sub> /ΔT |       | 0.06 |       | nm/°C |       |
| RMS Spectral Bandwidth                  |                                                | Δλ                  |       |      | 0.65  | nm    | 9     |
| Laser Forward Voltage                   | I <sub>F</sub> =6.7mA                          | V <sub>F</sub>      | 1.5   | 1.8  | 2.2   | V     |       |
| Laser Reverse Voltage                   | I <sub>R</sub> = 10μA                          | V <sub>R</sub>      | 5     | 10   |       | V     |       |
| Rise/Fall Time                          | Bias above threshold 20%-80%                   | T <sub>R</sub>      |       |      | 50    | ps    | 4     |
|                                         |                                                | T <sub>F</sub>      |       |      | 50    |       |       |
| Relative Intensity Noise                |                                                | RIN <sub>12</sub>   |       |      | -128  | dB/Hz | 5,9   |
| Series Resistance                       | T <sub>A</sub> = 25°C, I <sub>F</sub> =6.7mA   | R                   | 35    | 50   | 60    | Ohms  | 9     |
|                                         | T <sub>A</sub> = 85°C                          |                     | 25    |      |       |       |       |
|                                         | T <sub>A</sub> = -5°C                          |                     |       |      | 75    |       |       |
| Series Resistance Temperature Variation | I <sub>F</sub> =6.7mA                          | ΔR/ΔT               |       | -0.2 |       | %/°C  |       |
| Encircled Flux Diameter                 |                                                | EF                  |       |      |       |       | 6,9   |

| Photodiode Parameters                 | Test Condition                                          | Symbol               | Min. | Typ. | Max. | Units | Notes |
|---------------------------------------|---------------------------------------------------------|----------------------|------|------|------|-------|-------|
| Monitor Current                       | P <sub>OC</sub> =0.47mW, V <sub>R</sub> =3V             | I <sub>PD</sub>      | 100  | 250  | 500  | μA    |       |
| Monitor Current Temperature Variation | P <sub>OC</sub> =0.47mW<br>T <sub>A</sub> = -5 to 85°C  | ΔI <sub>pd</sub> /ΔT |      | 0.0  |      | %/°C  |       |
| Tracking Ratio Variation (Open Bore)  | P <sub>OB</sub> =-2.5dBm<br>T <sub>A</sub> = -5 to 85°C | ΔTR                  | -0.5 |      | +0.5 | dB    |       |
| Dark Current                          | P <sub>OC</sub> =0mW, V <sub>R</sub> =3V                | I <sub>DARK</sub>    |      |      | 20   | nA    |       |
| PD Reverse Voltage                    | P <sub>OC</sub> =0mW, I <sub>R</sub> =10μA              | BVR <sub>PD</sub>    | 30   | 115  |      | V     | 7     |
| PD Capacitance                        | V <sub>R</sub> =0V, Freq=1MHz                           | C <sub>PD</sub>      |      | 75   | 100  | pF    |       |
|                                       | V <sub>R</sub> =3V, Freq=1MHz                           |                      |      | 40   | 55   |       |       |

## NOTES

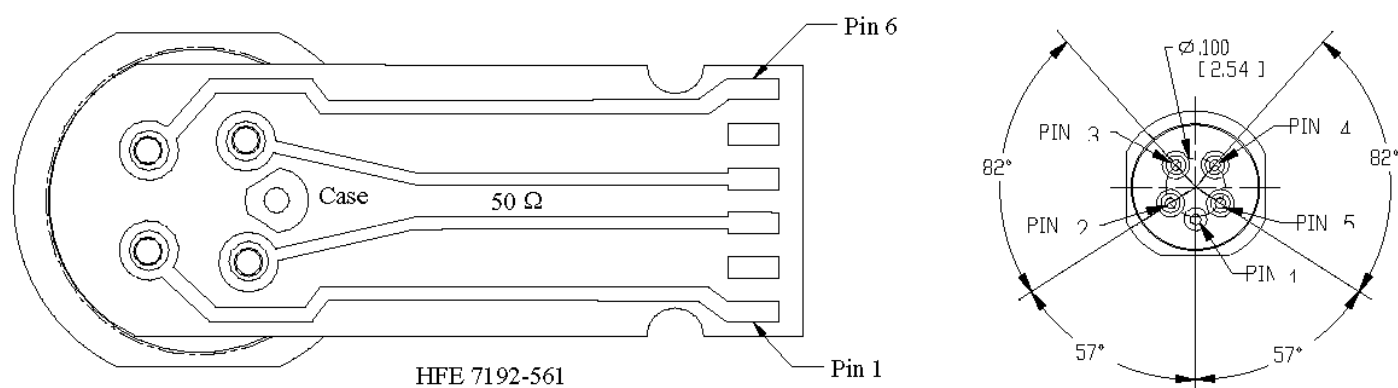
1. PO\_PCT is defined as the ratio of the coupled power into a 50/125 micron fiber to the total power output from the optical front end as measured on a large area detector.
2. Operation outside of the specified range may result in the threshold current exceeding the maximums defined in the electro-optical characteristics table.  $\Delta I_{TH}$  is the maximum deviation from the 25°C value.
3. Slope efficiency is defined as  $\Delta P_O / \Delta I_F$  at a total power output of 0.47mW. Slope efficiency is intentionally lowered to the value shown by attenuation. See recommended Bias Profile below for P<sub>OC</sub> setup details.
4. Rise and fall times are sensitive to drive electronics. Rise and fall times are measured 20%-80% using a 1GHz square wave AC coupled to the VCSEL using a bias-T. The DC current is adjusted to achieve a minimum OMA of -4dBm. Corrections are made for finite detector bandwidth.
5.  $RIN_{12}$  is measured using the OMA technique with 12dB return.
6. Encircled flux is measured per TIA-455-203.
7. To prevent VCSEL damage, short the VCSEL anode and cathode during BVR testing of the photodiode.
8. Operation of the HFE7192-xxx is critically dependent upon the quality of the electrical interface between the TO can and the customer PCB. All specifications are tested with the optional flex interface circuit. Modulation performance without the flex circuit will be impaired
9. Using recommended bias profile shown below. OMA level is for beginning of life and accounts for aging.

## RECOMMENDED BIAS PROFILE

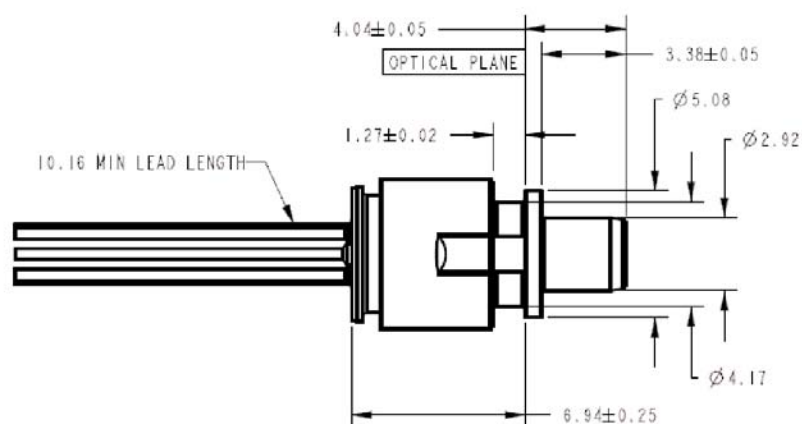
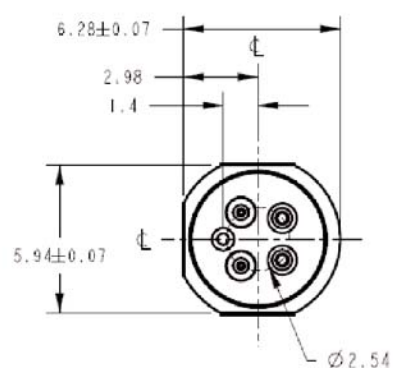
In order to maintain maximum output quality while maintaining an ample high temperature margin for reliability and rollover, a temperature dependent bias profile is recommended. To define this profile, the back monitor current IPD needs to be measured for a fiber coupled power of -3, -3.3, and -3.5 dBm, respectively. The BOL tracking profile then includes the recorded IPD values at -3 dBm for -5C, -3.3 dBm for 25C, and -3.5 dBm at 85C. This programming can be derived from room temperature measurements; measurement over temperature can be used for increased accuracy.

## PINOUT

| PIN | HFE7192-581   | HFE7192-681   | PIN | HFE7192-561 (Flex) | HFE7192-661 (Flex) |
|-----|---------------|---------------|-----|--------------------|--------------------|
| 1   | Case          | Case          | 1   | MPD Cathode        | MPD Cathode        |
| 2   | VCSEL Anode   | VCSEL Cathode | 2   | Case               | Case               |
| 3   | MPD Cathode   | MPD Cathode   | 3   | VCSEL Anode        | VCSEL Cathode      |
| 4   | MPD Anode     | MPD Anode     | 4   | VCSEL Cathode      | VCSEL Anode        |
| 5   | VCSEL Cathode | VCSEL Anode   | 5   | Case               | Case               |
|     |               |               | 6   | MPD Anode          | MPD Anode          |



## MOUNTING DIMENSIONS - LC TOSA HFE7192-X81

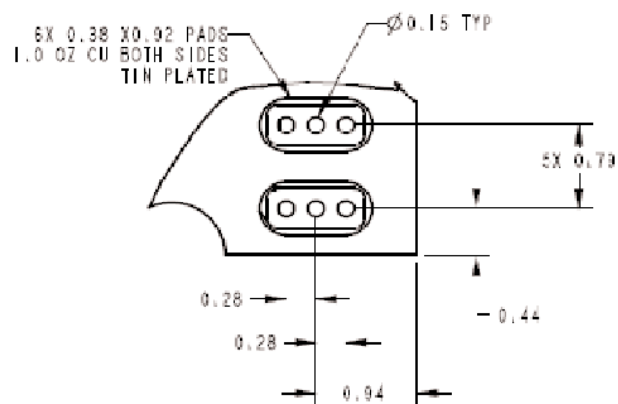
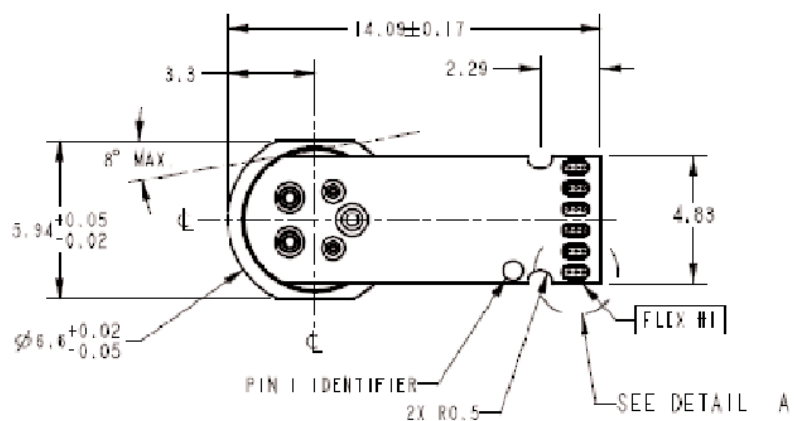


MOUNTING DIMENSIONS (for reference only): All dimensions in mm.

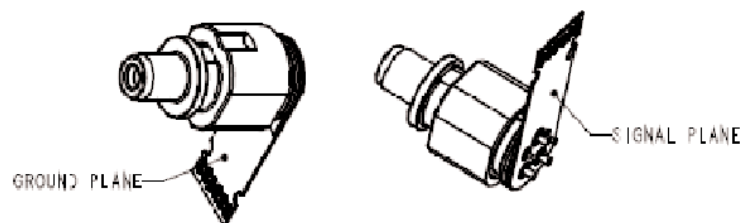
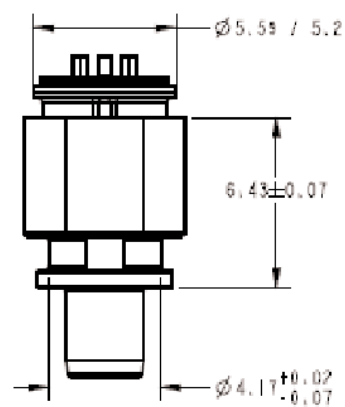
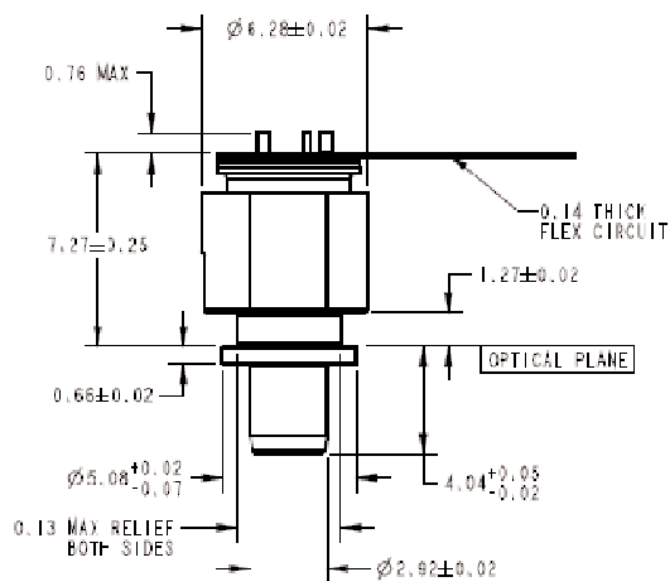
## MOUNTING DIMENSIONS - LC TOSA

(for reference only):

All dimensions in mms.



DETAIL - A  
SCALE 20



## ADVANCED OPTICAL COMPONENTS

Finisar's ADVANCED OPTICAL COMPONENTS division was formed through strategic acquisition of key optical component suppliers. The company has led the industry in high volume Vertical Cavity Surface Emitting Laser (VCSEL) and associated detector technology since 1996. VCSELs have become the primary laser source for optical data communication, and are rapidly expanding into a wide variety of sensor applications. VCSELs' superior reliability, low drive current, high coupled power, narrow and circularly symmetric beam and versatile packaging options (including arrays) are enabling solutions not possible with other optical technologies. ADVANCED OPTICAL COMPONENTS is also a key supplier of Fabrey-Perot (FP) and Distributed Feedback (DFB) Lasers, and Optical Isolators (OI) for use in single mode fiber data and telecommunications networks

## LOCATION

- Allen, TX - Business unit headquarters, VCSEL wafer growth, wafer fabrication and TO package assembly.
- Fremont, CA – Wafer growth and fabrication of 1310 to 1550nm FP and DFB lasers.
- Shanghai, PRC – Optical passives assembly, including optical isolators and splitters.

## SALES AND SERVICE

Finisar's ADVANCED OPTICAL COMPONENTS division serves its customers through a worldwide network of sales offices and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact a nearby sales office or call the number listed below.

## AOC CAPABILITIES

ADVANCED OPTICAL COMPONENTS' advanced capabilities include:

- 1, 2, 4, 8, and 10Gbps serial VCSEL solutions
- 1, 2, 4, 8, and 10Gbps serial SW DETECTOR solutions
- VCSEL and detector arrays
- 1, 2, 4, 8, and 10Gbps FP and DFB solutions at 1310 and 1550nm
- 1, 2, 4, 8, and 10Gbps serial LW DETECTOR solutions
- Optical Isolators from 1260 to 1600nm range
- Laser packaging in TO46, TO56, and Optical subassemblies with SC, LC, and MU interfaces for communication networks
- VCSELs operating at 670nm, 780nm, 980nm, and 1310nm in development
- Sensor packages include surface mount, various plastics, chip on board, chipscale packages, etc.
- Custom packaging options

***Finisar*****Advanced Optical Components Division**

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