

Product Specification

4.25Gbps 850nm VCSEL, LC TOSA

HFE4192-581, HFE4192-582

PRODUCT FEATURES

- 850nm multi-mode oxide isolated VCSEL
- Capable of modulation operation from DC to 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



This product is a 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.

It is designed to be used with inexpensive silicon or gallium arsenide detectors, but excellent performance can also be achieved with some indium gallium arsenide detectors.

The low drive current requirement makes direct drive from PECL (Positive Emitter Coupled Logic) or ECL (Emitter Coupled Logic) gates possible and eases driver design.

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

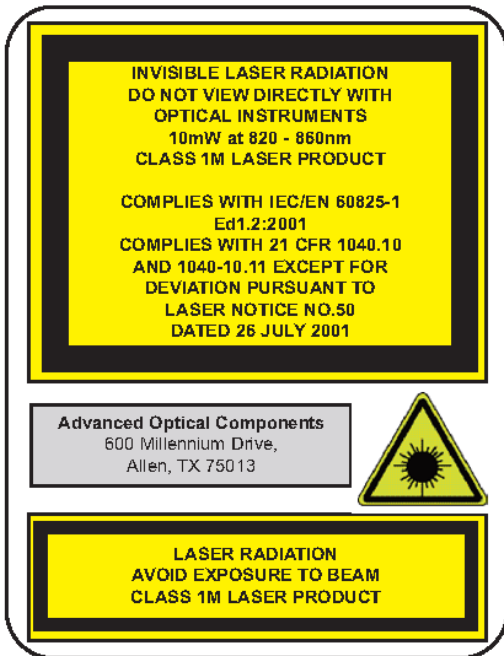
PRODUCT SELECTION

Part Number	Description
HFE4192-581	LC TOSA with attenuated optics, monitor photodiode, normal polarity
HFE4192-582	LC TOSA with attenuated optics, monitor photodiode, reverse polarity

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
Photodiode reverse voltage	5V
Photodiode reverse current	2mA
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 ($T_A=25^\circ\text{C}$ unless otherwise stated)

VCSEL Parameters	Test Condition	Symbol	Min.	Typ.	Max.	Units	Notes
Average Fiber Coupled Power	$I_F = 7\text{mA}$	P_{OC}		0.4		mW	2
Minimum coupling efficiency including wiggle	$I_F = 7\text{mA}$		55			%	2
Threshold Current		I_{TH}	0.5	1.5	2	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}			1.5	mA	3
Temperature at minimum threshold current		T_O	-30		10	$^\circ\text{C}$	3
Slope Efficiency	$T_A = 25^\circ\text{C}$	η	0.05	0.07	0.09	mW/mA	4
	$T_A = -40^\circ\text{C}$	η			0.13	mW/mA	
	$T_A = 85^\circ\text{C}$	η	0.035			mW/mA	
Slope Efficiency Temperature variation	$T_A = -40^\circ\text{C}$ to 85°C	$\Delta\eta/\Delta T$		-6000		ppm/ $^\circ\text{C}$	5
Peak Wavelength	$I_F = 7\text{mA}$, $T_A = -40^\circ\text{C}$ 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/ $^\circ\text{C}$	
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	
Laser Resonance Frequency	$I_F/I_{TH} = 4$	ROF	5			GHz	10
Minimum Bias Relative to I_{th}	$T_A = -40^\circ\text{C}$ to 85°C	r		4			10
Rise and Fall Times	$P_{avg} = 0.400\text{mW}$, Extinction Ratio = 10	t_r t_f			90 90	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	$I_F = 7\text{mA}$, $T_A = -40^\circ\text{C}$ to 85°C	$\Delta R_S/\Delta T$		-3000		ppm/ $^\circ\text{C}$	7
Photodiode Parameters	Test Condition	Symbol	Min.	Typ.	Max.	Units	Notes
Monitor Current	$P_O = 0.4\text{mW}$, $T_A = 25^\circ\text{C}$	I_{PD}	0.3	0.5	0.85	mA	8
	$P_O = 0.4\text{mW}$, $T_A = -40^\circ\text{C}$	I_{PD}	0.27	0.5	0.95		8
	$P_O = 0.4\text{mW}$, $T_A = +85^\circ\text{C}$	I_{PD}	0.27	0.5	0.95	mA	8
Mon. Current Temp. Variation	$P_O = 0.4\text{mW}$, -40°C to 85°C	$\Delta I_{PD}/\Delta T$	-0.1	0	0.1	%/ $^\circ\text{C}$	8
Monitor Current Tracking		ΔI_{trk}	.8	1	1.2		8,9
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	C		75	100	pF	
	$V_R = 3\text{V}$, Freq = 1MHz			40	55		

Notes:

- 1) Reliability is a function of temperature, see www.adopco.com for details.
- 2) For the purpose of these tests, I_F is DC current.
- 3) Threshold current varies as $(T_A - T_0)^2$. It may either increase or decrease with temperature, depending upon relationship of T_A to T_0 . The magnitude of the change is proportional to the threshold at T_0 .
- 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 <80ps fall time.
- 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) These specifications are for the TOSA component alone. Reflections introduced by any subsequent higher level assembly may affect these values.
- 9) Monitor current tracking is defined as follows:

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

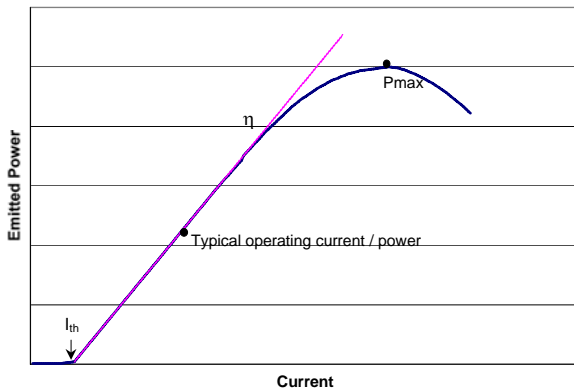
- 10) Relaxation Oscillation Frequency (ROF) is determined by the relationship:

$$\text{ROF} = \frac{1}{2\pi} \cdot \sqrt{\frac{r-1}{t_c \cdot \tau_2} - \frac{r}{t_2}}$$

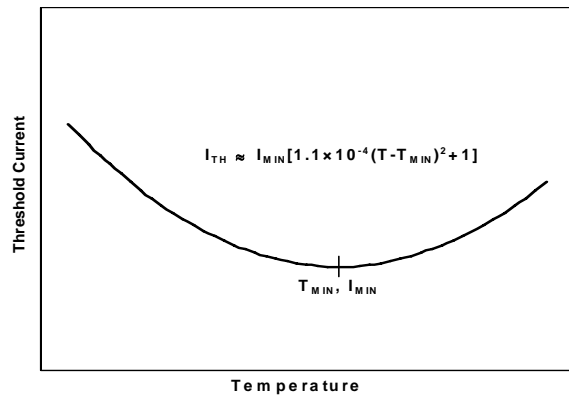
Where $r = I_F / I_{TH}$, t_c is the photon lifetime (2.5ps), and τ_2 is the spontaneous emission lifetime (1ns). Both t_c and τ_2 are functions of temperature. When operating at high temperature, the $r (I_F / I_{TH})$ value can be significantly reduced and still maintain adequate speed performance. This is recommended in order to preserve reliability.

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	

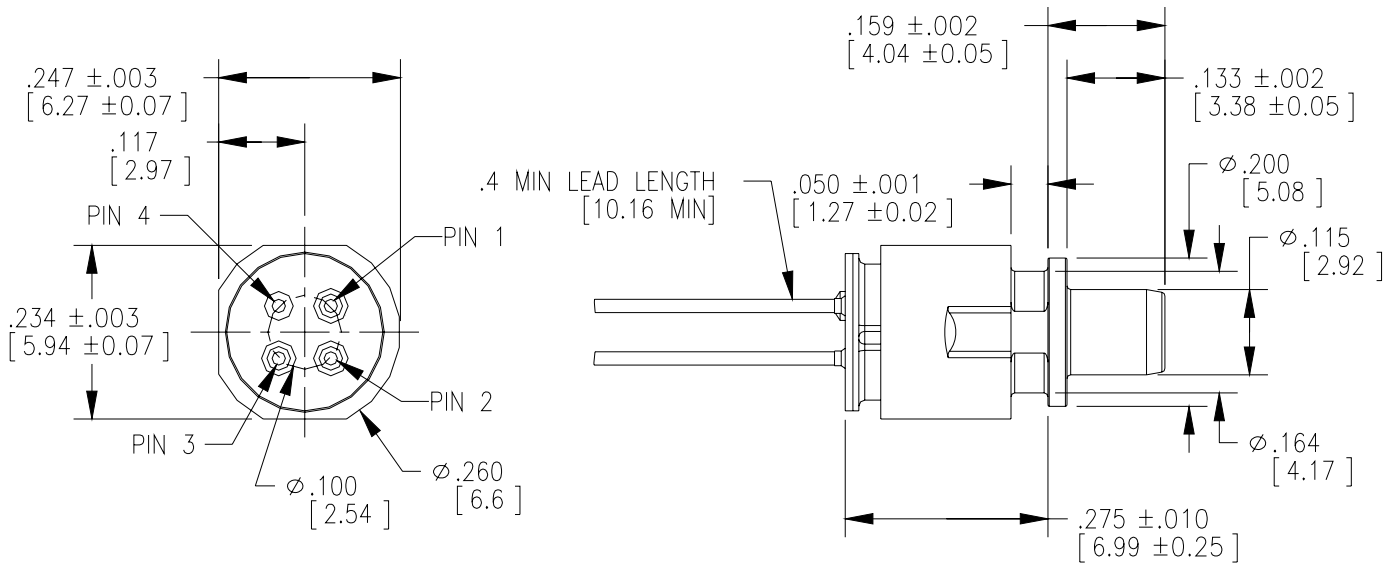
V. Regulatory Compliance

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

Number	HFE4192-581	HFE4192-582
1	VCSEL Cathode	VCSEL Anode
2	VCSEL Anode	VCSEL Cathode
3	Monitor Diode Cathode	Monitor Diode Cathode
4	Monitor Diode Anode (Case)	Monitor Diode Anode (Case)



All dimensions are in inches. [mm]

VII. Revision History

Revision	Date	Description
A1	4/26/2013	• Document created.

VIII. For More Information

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