Finisar

Product Specification

850nm Single Mode VCSEL TO-46 Package

HFE4093-332

PRODUCT FEATURES

- Designed for drive currents between 1 and 5 mA
- Optimized for low dependence of electrical properties over temperature
- High speed ≥1 GHz
- Packaged with a photodetector

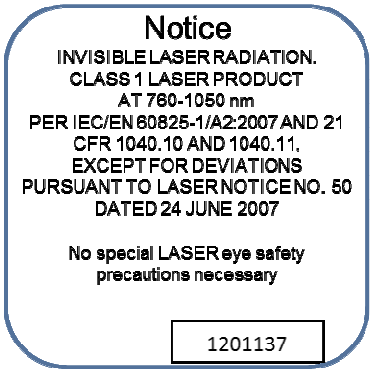
The HFE409x-332 is a high-performance 850 nm VCSEL (Vertical Cavity Surface-Emitting Laser) packaged for high-speed data communications. This product combines all the performance advantages of the VCSEL with a custom designed power monitor diode, and is designed for ease of use by the module designer and manufacturer. The power monitor diode can be used with appropriate feedback control circuitry to set a maximum power level for each VCSEL, simplifying design for high data rate communication and eye safety.
The HFE409x-332 is a high radiance VCSEL designed to convert electrical current into optical power that can be used in fiber optic communications and other applications. As the current varies above threshold, the light intensity increases proportionally.
The HFE409x-332 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 EML (Emitter Coupled Logic) gates possible and eases driver design.
The HFE409x-332 is designed to interface with single mode or 50/125 and 62.5/125 mm multimode fiber. HFE409x-332 produces a circularly symmetric, non-astigmatic, narrow divergence beams that, with appropriate lensing, fiber couple all of the emitter power.

PRODUCT SELECTION

Part Number	Description
HFE4093-332	Un-attenuated VCSEL with Back Monitor Photodiode - VCSEL Anode Common

I. Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	-40 to +85°C
Case Operating Temperature	0* to +50°C
Lead Solder Temperature	260°C, 10 sec.
Reverse Power Supply Voltage	5V
Laser continuous forward current	4mA
ESD Exposure (Human Body Model)	100V[1]



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

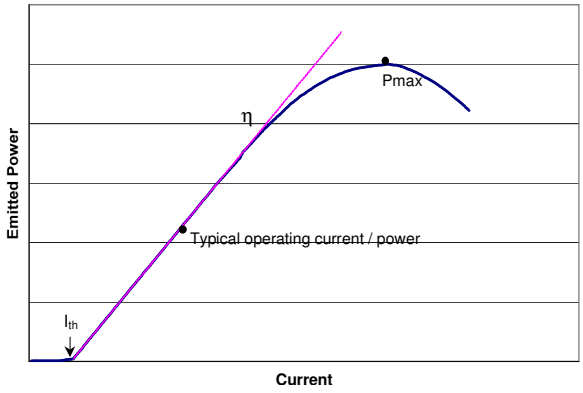
II. Electro-Optical Characteristics (T_{OP} = 25C unless otherwise stated)

VCSEL Parameters	Test Condition	Symbol	Min.	Typ.	Max.	Units	Notes
Optical Power Output	I_F=4mA	Po	0.7	1		mW	1
Threshold Current		I_{TH}			1.5	mA	
Threshold Current Temperature Variation	T_A = 0°C to 70°C	ΔI_{TH}	-1.5		1.5	mA	2
Slope Efficiency		η	0.25	0.35	0.6	mW/mA	3
Slope Efficiency Temperature variation	T_A = 0°C to 70°C	$\Delta\eta$ /ΔT		-6000		PPM/°C	
Peak Wavelength	I_F=4 mA	λ_P	835		870	nm	
λ_P Temperature Variation	I_F=4 mA	$\Delta\lambda_P/\Delta T$		0.06		nm/°C	
Laser Forward Voltage	I_F=4 mA	V_F		1.9	2.5	V	
Laser Reverse Voltage	I_R=10 µA	BVR_{LD}		-10		V	
Rise and Fall Times	Prebias Above Threshold, 20%-80%	t_r, t_f		150		ps	4
Series Resistance	I_F=4 mA	R_S	75	110	150	Ohms	
Series Resistance Temperature Coefficient	I_F=4 mA, 0°C to 70°C	dR_s/dT		-2000		PPM/°C	
Side Mode Suppression Ratio	I_F=4mA	SMSR	15	30		dB	
Change in wavelength with current		$\Delta\lambda_P/\Delta I$		0.25		mA/nm	
Beam Divergence		Θ_{FWHM}		11	20	Degrees	
Photodiode Parameters	**Test Condition**	**Symbol**	**Min.**	**Typ.**	**Max.**	**Units**	**Notes**
Monitor Current	Po = 1mW	I_{PD}		0.035		mA	
Monitor current Temperature Variation	Po = 1mW	$\Delta I_{PD}/\Delta T$		0.2		%/°C	
Dark Current	Po =0mW, V_R=3V	I_D			20	nA	
PD Reverse Voltage	Po =0mW, I_R=10 µA	BVR_{PD}	30	115		V	5
PD Capacitance	V_R=0V, Freq=1MHz V_R=3V, Freq=1MHz	C		75 40	100 55	pF	

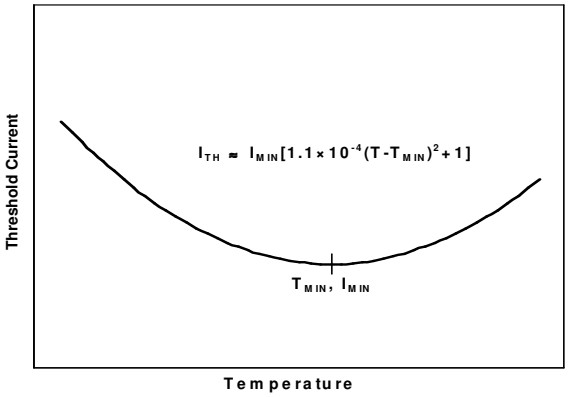
Notes:
1. Operating power is set by the peak operating current $I_{PEAK}=I_{BIAS}+I_{MODULATION}$.
2. Operation at temperatures outside the specified range may result in the threshold current exceeding the maximums defined in the electro-optical characteristics table.
3. Slope efficiency is defined as ΔPo/ΔIF
4. Rise and fall times are sensitive to drive electronics
5. To safeguard the VCSEL from current spike damage, short the VCSEL anode and cathode to each other during photodiode BVR verification testing. Additionally to safeguard the PIN photodiode, limit the photodiode reverse voltage in accordance with the absolute maximum rating.

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.



Typical characteristics of single mode VCSELs

They are even more sensitive to ESD than are multi-mode VCSELs or CD lasers. They operate at currents typically below 5 mA and should never be driven at much higher currents. The spectral peak shifts significantly with current, but shifts only slowly with ambient temperature. Operation at a particular wavelength can be achieved by first setting the current at an appropriate level, then adjusting the temperature. While they are designed to stay single mode over the whole operating current range, at very high currents they may become multi-mode, increasing the spectral width and the beam divergence.

IV. Environmental Specifications

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	T_{op}	0		50	°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	9521487

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

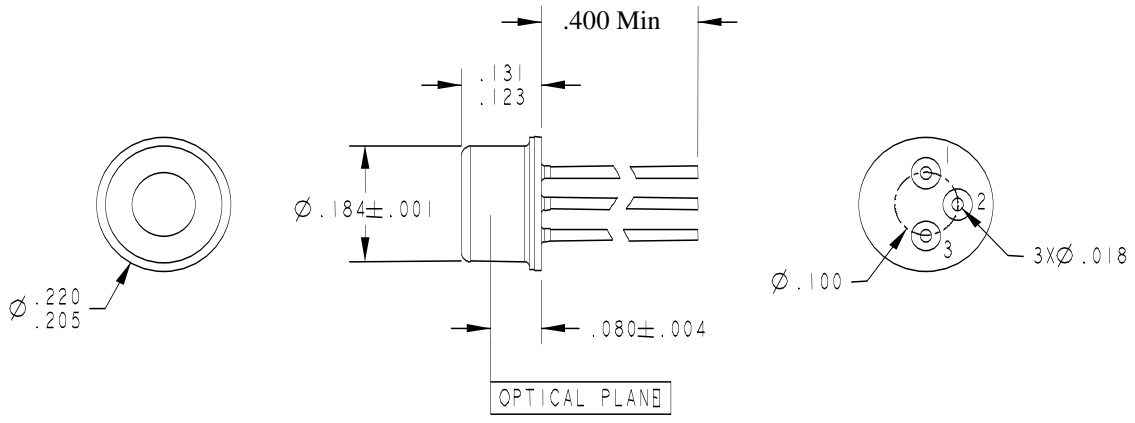
VI. Mechanical Specifications

PIN	Description
1	K_{LD}
2	K_{PD}, A_{LD}
3	A_{PD}

LEAD DESCRIPTIONS

A_{LD}	VCSEL Anode	A_{PD}	Monitor Photodiode Anode
K_{LD}	VCSEL Cathode	K_{PD}	Monitor Photodiode Cathode

(dimensions are in mm)



VII. Revision History

Revision	Date	Description
B00	10/14/2014	• Converted to Finisar Standard Format

VIII. For More Information

Finisar Corporation
1389 Moffett Park Drive
Sunnyvale, CA 94089-1133
Tel. 1-408-548-1000
Fax 1-408-541-6138
sales@finisar.com
www.finisar.com

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