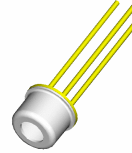


High Speed VCSEL 2.5Gbps

FEATURES

- Designed for drive currents between 5 and 15 mA
- Optimized for low dependence of electrical properties over temperature
- High speed ≥ 1 GHz
- Two different laser/photodiode polarities
- Attenuating coating also available
- Packaged with a photodetector



The HFE409x-322 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-322 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-322 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-322 is designed to interface with 50/125 and 62.5/125 μm multimode fiber. They product circularly symmetric, non-astigmatic, narrow divergence beams that, with appropriate lensing, fiber couple all of the emitter power.

Fiber Optic LAN Components

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HFE409x-322

ABSOLUTE MAXIMUM RATINGS

Parameter	Rating
Storage Temperature	-40 to +125°C
Operating Temperature	0 to +70°C
Lead Solder Temperature	260°C, 10 sec.
Continuous Optical Output Power (Any Current)	5 mW
Laser Diode Reverse Voltage ($I_R=10 \mu A$)	5 V
Laser Continuous Forward Current, Heat-Sinked	15 mA
PIN Photodiode Forward Current	10 mA

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.

ELECTRO-OPTICAL CHARACTERISTICS ($T_A=25^\circ C$ unless otherwise stated)

VCSEL Parameters	Test Condition	Symbol	Min.	Typ.	Max.	Units	Notes
Peak Operating Current	Adjustable to establish operating power	I_{peak}		9	20	mA	1
Optical Power Output	$I_F=9mA$	P_o		2.4		mW	1
Threshold Current		I_{TH}	1	3	5	mA	
Threshold Current Temperature Variation	$T_A = 0^\circ C$ to $70^\circ C$	ΔI_{TH}	-1.5		1.5	mA	2
Slope Efficiency		η	0.225	0.4	0.6	mW/mA	3
Slope Efficiency Temperature variation	$T_A = 0^\circ C$ to $70^\circ C$	$\Delta\eta / \Delta T$		-6000		PPM/ $^\circ C$	
Peak Wavelength	$I_F=9 mA$	λ_p	830	850	860	nm	
λ_p Temperature Variation	$I_F=9 mA$	$\Delta\lambda_p / \Delta T$		0.06		nm/ $^\circ C$	
Spectral Bandwidth, RMS	$I_F=9 mA$	$\Delta\lambda$			0.85	nm	
Laser Forward Voltage	$I_F=9 mA$	V_F		1.8	2.2	V	
Laser Reverse Voltage	$I_R=10 \mu A$	BVR_{LD}		-10		V	
Rise and Fall Times	Prebias Above Threshold, 20%-80%	t_r t_f			130 150	ps	4
Relative Intensity Noise	1 GHz BW, $I_F=9 mA$	RIN		-130	-122	dB/Hz	
Series Resistance	$I_F=9 mA$	R_S	18	25	40	Ohms	
Series Resistance Temperature Coefficient	$I_F=9 mA$, $0^\circ C$ to $70^\circ C$	dR_S / dT		-3000		PPM/ $^\circ C$	
Beam Divergence		θ	15		30	Degrees	5
Photodiode Parameters	Test Condition	Symbol	Min.	Typ.	Max.	Units	Notes
Monitor Current	$P_o = 1.8mW$	I_{PD}		0.022		mA	
Monitor current Temperature Variation	$P_o = 1.8mW$	$\Delta I_{PD} / \Delta T$		0.2		%/ $^\circ C$	
Dark Current	$P_o = 0mW$, $V_R=3V$	I_D			20	nA	
PD Reverse Voltage	$P_o = 0mW$, $I_R=10 \mu A$	BVR_{PD}	30	115		V	6
PD Capacitance	$V_R=0V$, Freq=1MHz	C		75	100	pF	
	$V_R=3V$, Freq=1MHz			40	55		

Fiber Optic Components

High Speed VCSEL 2.5Gbps VCSEL

HFE409x-322

Notes:

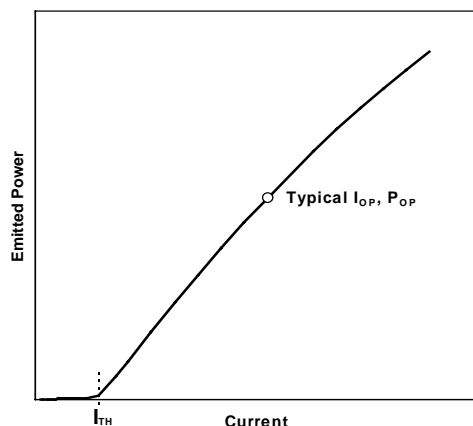
1. Operating power is set by the peak operating current $I_{PEAK} = I_{BIAS} + I_{MODULATION}$.
2. Operation at temperatures outside the specified range may result in the threshold current exceeding the maximums defined in the electro-optical characteristics table.
3. Slope efficiency is defined as $\Delta P_o / \Delta I_f$ at a total power output of 1.8 mW.
4. Rise and fall times are sensitive to drive electronics
5. Beam divergence is defined as the total included angle between the $1/e^2$ intensity points. Beam divergence

varies between 15deg and 30deg depending upon operating conditions. 30deg is expected to be worst case divergence. It is recommended that the optics be design for an NA of 0.3

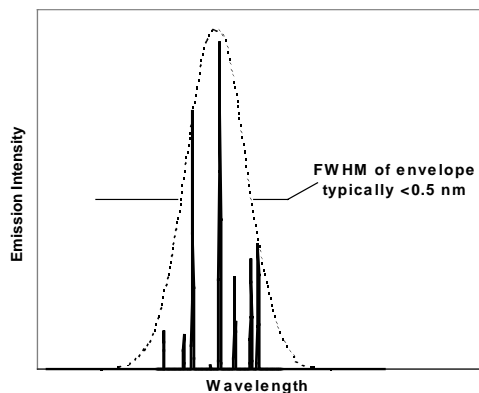
6. To safeguard the VCSEL from current spike damage, short the VCSEL anode and cathode to each other during photodiode BVR verification testing. Additionally to safeguard the PIN photodiode, limit the photodiode reverse voltage in accordance with the absolute maximum rating.

TYPICAL PERFORMANCE CURVES

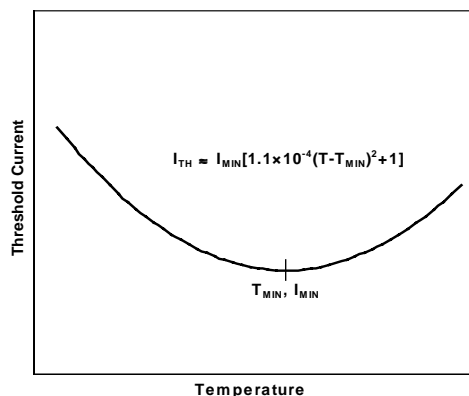
Emitted Power vs. Current: Power varies approximately linearly with current above threshold.



Emission Intensity vs. Wavelength: Typical 10 mA spectrum comprises multiple lines corresponding to multiple transverse modes.



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



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.



The VCSEL is a class IIIb laser and should be treated as a potential eye hazard. Due to the size of the component, the applicable warning logotype, aperture label, and certification/identification label cannot be placed on the component itself. These labels can be found on the individual envelope in which the VCSEL unit is packaged, or attached to the shipping package.

Fiber Optic LAN Components

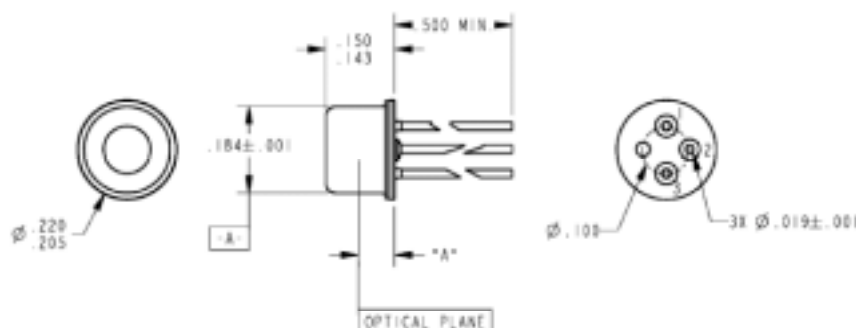
High Speed VCSEL 2.5Gbps VCSEL

HFE409x-322

ORDER GUIDE

Catalog Listing	Description
HFE4093-322	Unattenuated VCSEL with Back Monitor Photodiode - VCSEL Anode Common
HFE4094-322	Unattenuated VCSEL with Back Monitor Photodiode - VCSEL Cathode Common

MOUNTING DIMENSIONS (for reference only): in./(mm)



DIMENSION A = 0.080±0.004

PINOUT

HFE4093-322		HFE4094-322	
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}

PINOUT DEFINITIONS

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

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Commencing with the date of shipment, Honeywell's warranty runs for 18 months. If warranted goods are returned to Honeywell during that period of coverage, Honeywell will repair or replace without charge those items it finds defective. The foregoing is Buyer's sole remedy and is **in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose.**

While we provide application assistance, personally and through our literature, it is up to the customer to determine the suitability of the product in the application.

7/6/01

Specifications may change at any time without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

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