DATA SHEET

1.25GBPS 850NM VCSEL TO-46 PACKAGE

HFE408X-321

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
- Packaged with a photodetector

The HFE408x-321 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. The power monitor diode can be used with appropriate feedback control circuitry to set a maximum power level for each VCSEL. In addition, built-in power attenuation reduces the effective slope efficiency. These combined features simplify design for high data rate communication and eye safety.

The HFE408x-321 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 HFE408x-321 is designed to be used with inexpensive silicon or gallium arsenide detectors (see HFD3081-103, HFD3081-108), but excellent performance can also be achieved with some indium gallium arsenide detectors.

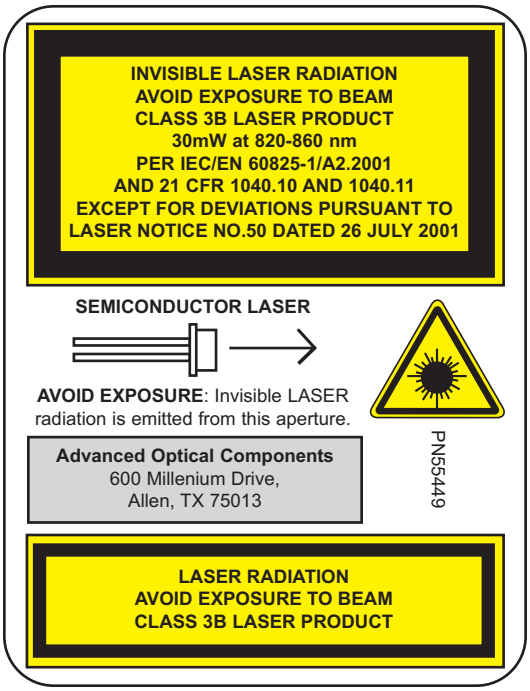
The low drive current requirement makes direct drive from PECL (Positive Emitter Coupled Logic) or EML (Emitter Coupled Logic) gates possible and eases driver design.

The HFE408x-321 is designed to interface with 50/125 and 62.5/125 μm multi-mode fiber. They product circularly symmetric, non-astigmatic, narrow divergence beams that, with appropriate lensing, fiber couple all of the emitter power.

Part Number	Description
HFE4081-321	Attenuated VCSEL with Back Monitor Photodiode - VCSEL Anode Common
HFE4082-321	Attenuated VCSEL with Back Monitor Photodiode - VCSEL Cathode Common

Finisar
Advanced Optical Components Division

ABSOLUTE MAXIMUM RATINGS



Parameter	Rating
Storage temperature	-40°C to +100°C
Operating temperature	0°C to +70°C
Lead solder temperature	260°C, 10 seconds
Laser continuous average current	15mA
Laser peak forward current with pulse width less than 1µs	20mA
Laser reverse voltage	5V

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.

ELECTRICAL-OPTICAL CHARACTERISTICS

VCSEL Parameters	Test Condition	Symbol	Min.	Typ.	Max.	Units	Notes
Peak Operating Current	Adjustable to establish operating power	I_{peak}		12	20	mA	2
Optical Power Output	I_F=12mA	Po	0.3	0.6	1.2	mW	2,3
Threshold Current		I_{TH}	1.5	3.5	6	mA	
Threshold Current Temperature Variation	T_A= 0 °C to 70 °C	ΔI_{TH}	-1.5		1.5	mA	4
Slope Efficiency	Po =0.5mW	η	0.04	0.1	0.16	mW/mA	5
Slope Efficiency Temperature variation	T_A= 0 °C to 70 °C	$\Delta\eta / \Delta T$		-0.5		%/ °C	
Peak Wavelength	I_F=12mA	λ_P	830	850	860	nm	
λ_P Temperature Variation	I_F=12mA	$\Delta\lambda_P / \Delta T$		0.06		nm/ °C	
Spectral Bandwidth, RMS	I_F=12mA	$\Delta\lambda$			0.85	nm	
Laser Forward Voltage	I_F=12 mA	V_F	1.6	1.8	2.2	V	
Laser Reverse Voltage	I_R=10 µA	BVR_{LD}	5	10		V	
Rise and Fall Times	Prebias Above Threshold, 20% -80%	t_r t_f		150 200	300 300	ps	6
Relative Intensity Noise	1 GHz BW, I_F=12mA	RIN		-128	-122	dB/Hz	
Series Resistance	I_F =12 mA	R_S	18	25	40	Ohms	
Beam Divergence	I_F =12 mA	θ	5	15	20	Degrees	7
Photodiode Parameters	**Test Condition**	**Symbol**	**Min.**	**Typ.**	**Max.**	**Units**	**Notes**
Monitor Current	Po =0.5mW	I_{PD}	0.07 5		0.250	mA	
Monitor current Temperature Variation	Po =0.5mW	$\Delta I_{PD} / \Delta T$		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	8
PD Capacitance	V_R =0V, Freq=1MHz V_R =3V, Freq=1MHz	C		75 40	100 55	pF	

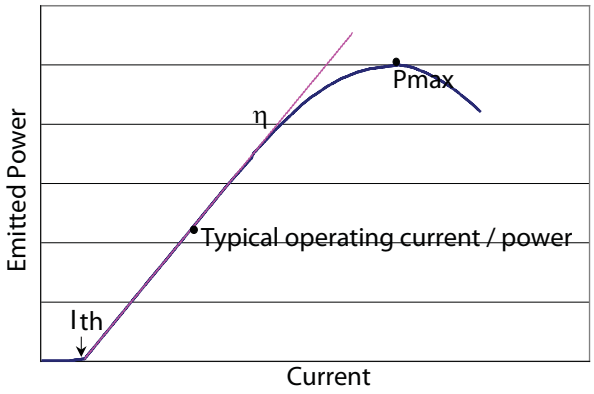
ELECTRO-OPTICAL CHARACTERISTICS (T_A=25 °C unless otherwise stated)

NOTES

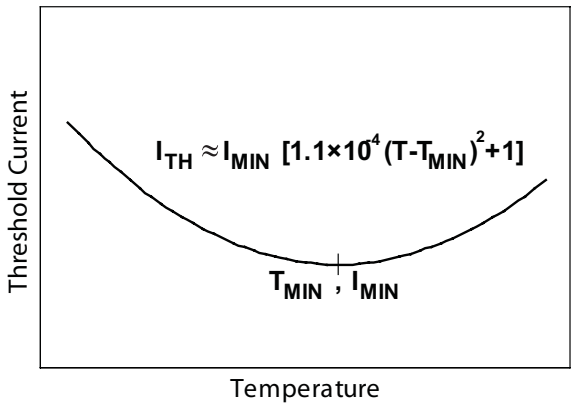
1. Reliability is a function of temperature, see www.finisar.com/aoc.php for details.
2. Operating power is set by the peak operating current $I_{PEAK}=I_{BIAS}+I_{MODULATION}$.
3. For the purpose of these tests, I_F is DC current.
4. Threshold current varies as $(T_A - T_O)^2$. It may either increase 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.
5. Slope efficiency is defined as $\Delta P_O/\Delta I_F$.
6. Rise and fall times specifications are the 20% - 80%. Most of the devices will measure <200ps fall time. Rise and fall times are sensitive to drive electronics.
7. Beam divergence is defined as the total included angle between the $1/e^2$ intensity points.
8. 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

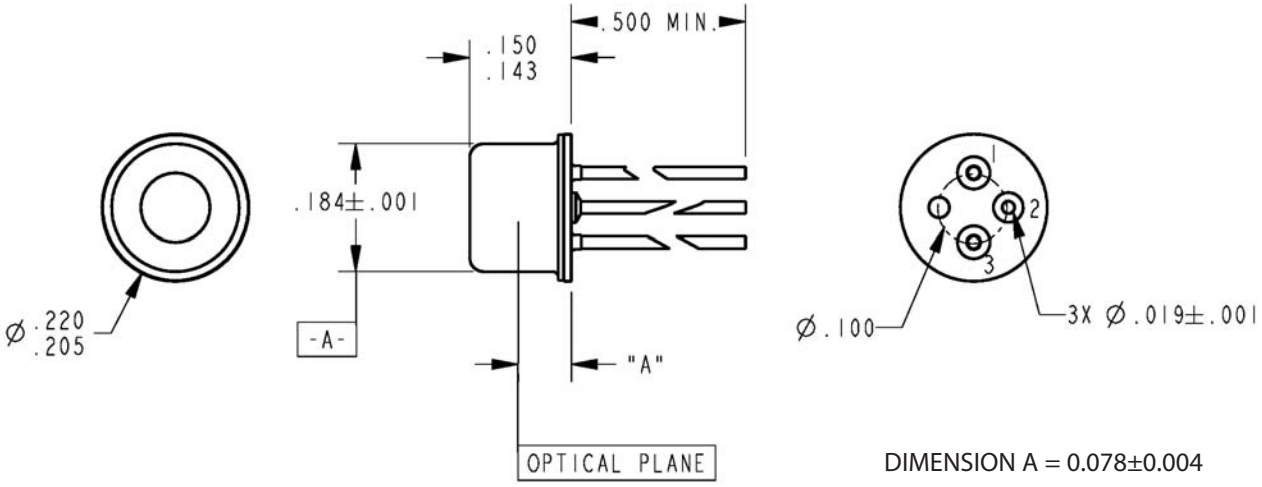
Emitted Power vs. Current: Power varies approximately linearly with current above threshold.



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



MOUNTING DIMENSIONS



DIMENSION A = 0.078±0.004

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

PINOUT

HFE4082-321		HFE4081-321	
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

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

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