

MINILASE OEM LASER MODULES

MACHINE VISION
ALIGNMENT & TARGETING
MANUFACTURING
INSTRUMENTATION
LIFE SCIENCES
3D IMAGING
SORTING & INSPECTION



WHEN PERFORMANCE MATTERS

BLUE SKY RESEARCH

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Blue Sky Research is a company dedicated to providing the best possible balance of performance, value and quality. We have fielded over 1 million lasers since our inception in 1989, and manufacture in OEM volumes. We offer "off the shelf" solutions or we can work with you, and provide a customized laser for your more exacting applications.

THE MINILASE FAMILY OF LASERS from Blue Sky Research has been designed to offer superior beam qualities in a compact package for OEM applications. The MiniLase products combine Blue Sky Research's VPS (virtual point source) lasers with high quality optics, solid packaging technologies and laser drive electronics. The MiniLase is offered with either a conventional, elliptical laser diode beam or a circular, diffraction-limited gaussian beam profile. A variety of wavelength, power and performance configurations are available, including; collimated, shaped or focused beams, laser drive electronics, built-in automatic power stabilization (APC) functions, and multiple wiring & connector options. All OEM solutions can be mass produced and delivered to meet your production timing and inventory requirements.

SPECIFYING PERFORMANCE, To answer whether you need a customized module or higher level assembly, a variety of parameters need to be considered. Understanding your system, and its optical performance requirements can often be a challenging task. In our experience and the optical beam properties of astigmatism, beam profile, and beam waist depth of focus, mechanical packaging, wavelength & optical power, environmental and electrical conditions and optical power stability are the most critical parameters that will affect your system performance.

ASTIGMATISM AND ITS CORRECTION - Astigmatism is a condition in which the apparent focal points of the two axis (vertical and horizontal) do not coincide. Because of the astigmatism, a focusing lens cannot truly focus the beam in both the x-z and the y-z planes on the "working" plane; It limits the ability to focus the laser beam to a small spot size and complicates focusing the output beam to a sharp well-defined point. Astigmatism can be corrected if necessary, please contact Blue Sky Research's Sales for more details.

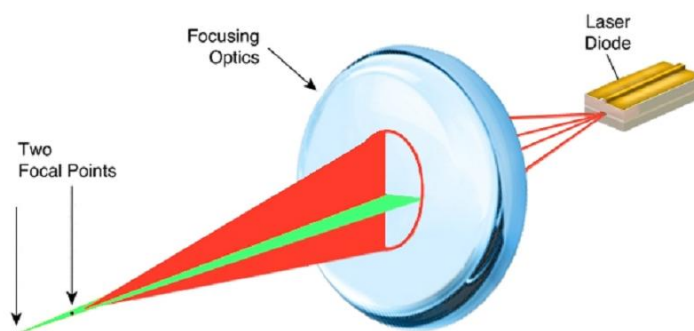


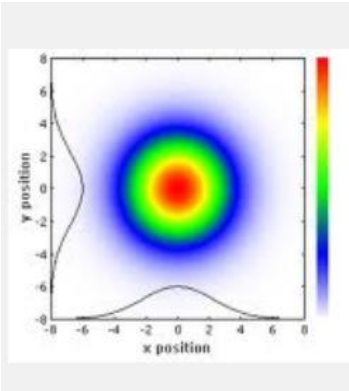
Diagram shows the problem of astigmatism, and how it can limit your optical system's performance in terms of focused beam shape and size. If precise beam placement or a small focused image is required by your system, astigmatism should be considered.

MECHANICAL PACKAGING



The housing is the outer case that protects all the components of the MiniLase module. Our housings are made from milled brass or anodized aluminum, and are available in a number of sizes, and mounting options, please see Mechanical Specifications section for exact dimensions. We also have the ability to design and build custom housings to meet your application. Overall size, wiring & connection requirements, operating environment, temperature variations, grounding, desired beam size and system mounting-placement are all considerations when choosing your mechanical package. Incorrect choices of materials will result in unstable beam parameters.

BEAM PROFILE AND BEAM SHAPE



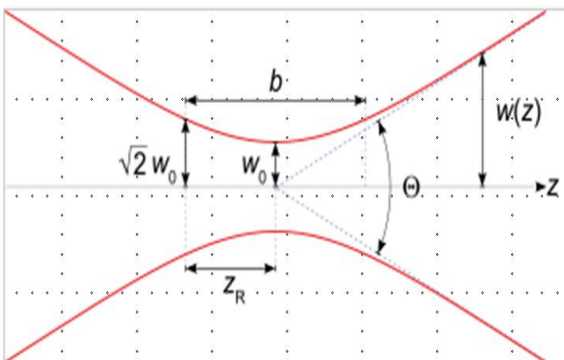
MiniLase products typically utilize our $\mu\text{lens}^{\text{TM}}$ technology to gain distinct performance advantages over traditional Laser Diode based modules using anamorphic prism pairs or beam circularizing apertures. Starting from a regular laser diode with elliptical beam & astigmatism, the $\mu\text{lens}^{\text{TM}}$ technology creates a virtual point source (VPS) laser beam with a gaussian-circular beam profile, and corrected astigmatism. At this point collimation or focusing optics may be added to precisely match your optical system requirements for beam size, shape and waist location.

A high-quality doublet or aspherical lens will be used to collimate or focus the beam, while maintaining its Gaussian, diffraction-limited quality. A good Gaussian profile ($M2 < 1.3$) and low wave front aberrations enable the beam from the MiniLase to be collimated

better or be focused into a smaller, more intense point.

BEAM WAIST DEPTH OF FOCUS

MicroLens technology also has an additional advantage, if used in conjunction with a doublet or aspheric lens to focus the laser, the lens combination circularizes the beam, minimizes astigmatism and the beam waist depth of focus is increased (b in diagram below). This has the affect of minimizing optical tolerances, relaxing tolerances on all associated opto-mechanical assemblies and enables superior optical performance. In effect with a large beam waist depth of focus you obtain maximum optical system performance with the minimum of mechanical tolerances and precision.



b = Beam Waist Depth of Focus
 $W(z)$ = Beam Diameter
 W_0 = smallest possible beam diameter at focal point
 Z_R = Rayleigh length (distance from W_0 to edge of beam waist focus)
 Z = direction of beam propagation
 θ = Beam divergence angle

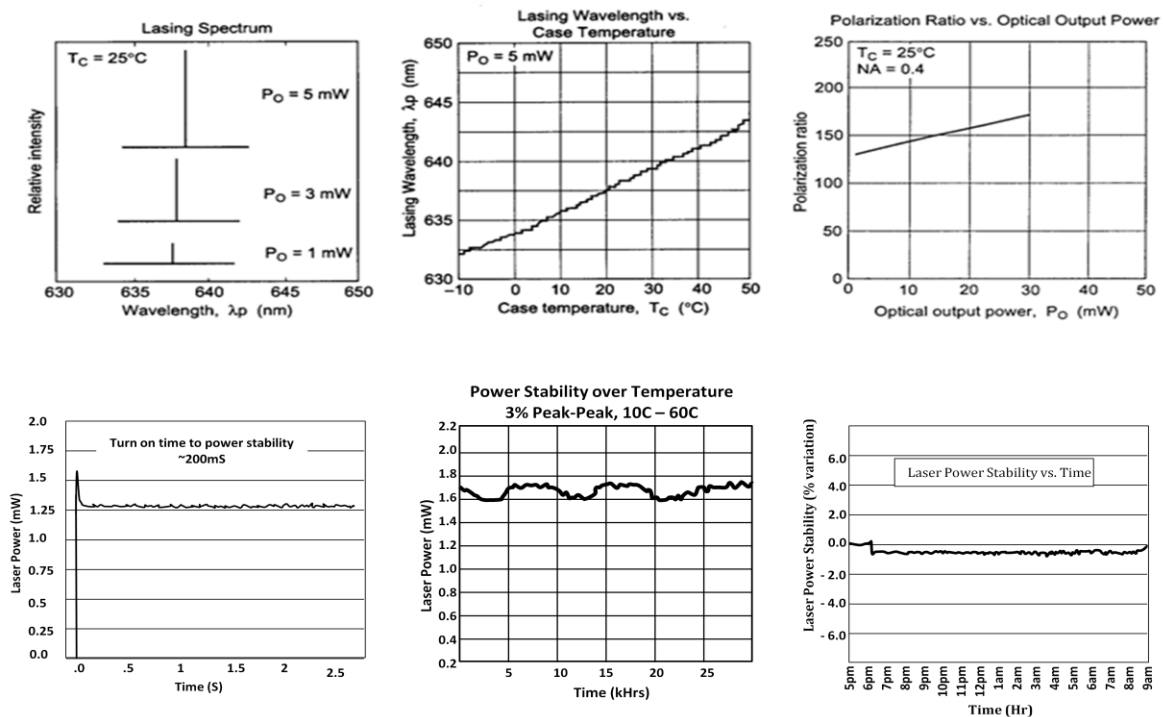
MINILASE OPTICAL CONFIGURATIONS

Configuration	Beam Shape Beam Profile	Astigmatism	Cost	Transmitted LD Power	Beam Waist Depth of Focus	Wavefront Quality
VPSL +Lens	Circular, Gaussian	Corrected	Medium	~80%	Large	Good
Selected VPSL* + Aspheric Lens	Circular, Gaussian	Corrected	Medium	~80%	Largest	Very Good
LD + Lens	Elliptical, Gaussian	5-15um	Low	~80%	Moderate	1-20% of power in side lobes
Anamorphic Prism Pairs	Circular, Gaussian	Correction requires additional lens	High	~50%	Low	Moderate
Beam Circularizing Apertures	Near Field Circular, Non-Gaussian	Correction requires additional lens	Medium	20 - 40%	Low	Side Lobes and diffraction rings

* Contact Blue Sky Sales for details on Selected VPSL models and power levels

MODULE PERFORMANCE

Typical laser module characteristics are shown below. Laser performance will vary depending on specific laser diode characteristic, supply voltage stability, operating voltage, and temperature. Please contact Blue Sky Research for specific laser diode operating characteristics.



WAVELENGTH OPTIONS

Wavelength (nm)	Diode Power (mW)							
	20	40	100	250				
405*	20	40	100	250				
450*	60	80						
520*	40	65						
633	80							
638	1	5	10	15	25	85*	140*	
655/660	1	5	30*	40	100			
670	1	5	10					
690	30*	45						
785	1	5	10	20	80	120		
808	120							
830	40	160						
850	1	5	10	40	160			
905/915	8	80	240					
980	40	240						

* NOT AVAILABLE WITH LASER DRIVER, CUSTOM OPTIONS POSSIBLE. PLEASE CONTACT BSR SALES

ELECTRICAL & ENVIRONMENTAL CONSIDERATIONS

Optical power stability is highly dependent on laser drive voltage stability, care should be taken in designing stable electrical circuits. To ease electrical design requirements, most MiniLase laser diodes can be ordered with operating voltages of 5V or 3.3V, and 28AWG is standard. Defined optical power levels are typically set at factory, if your system requires variable power, an adjustable power option is available (adjusts voltage, V_{cc} to laser). MiniLase brass mechanical packages have a voltage "positive" case, if your electrical design requires a case neutral configuration, an anodized Aluminum mechanical package is suggested. Blue Sky Research recommends all MiniLase modules be mounted to a heat sink, and it is required & essential for proper operation of all higher power MiniLase modules.

ELECTRICAL & ENVIRONMENTAL SPECIFICATIONS (Typical for most laser types)

Parameter	Specification	Comments
Input Power supply(Vcc)	3.3Vdc +/- 10%	5V for 3 wire (adjusted voltage control) option 3.3V or 5V may be specified for any laser driver
Case Electrical Polarity	Positive	Anodized Aluminum for case neutral
Operating Temperature	0-50 °C 0-60 °C	635nm, 650nm, 690nm 830nm, 850nm
Storage Temperature	-10 to 85°C	All wavelengths

OPTICAL SPECIFICATIONS (Typical for most laser types)

Parameter	Specification	Comments
Spectral Line width	<0.5nm typical	Will vary with individual laser Diode
Beam Aspect Ratio	≤1.25	Typical, selected VPSL approaches 1:1
Polarization	≥100:1 Typical	Proportional to increasing power
Power Stability	1hr, <1%	At stable temperature
Beam Diameter Tolerance	+/- 25%	Beam size is the diameter measured as 1/e ² aperture at the exit aperture of modules.
M ² Value	≤1.3	Typical, will vary with individual laser diode
Beam Pointing Stability	≤50μrad	@ 25°C, 8hrs
Beam Pointing accuracy	≤25mrad	@ 25°C
Centricity	≤0.25mm	typical

MINILASE BEAM & PACKAGING OPTIONS:

Wavelength (nm)	Beam Characteristics					Package Style
	Profile	Size (mm)	Focus Distance (mm)	Minimum Beam Diameter (mm) at 1m**	Beam Divergence @405 or 633nm (mrad)**	
405 - 520*	Collimated	1.0	NA	1.258	0.258	A*, E*
		1.5	NA	1.671	0.172	A*, E*
		2.5	NA	2.603	0.103	A*, E*
		4.0	NA	4.064	0.064	A*, E*
405 - 520*	Focused**		25 - 1000	0.025	NA	A*, E*
			25 - 1500	0.025	NA	A*, E*
			25 - 2000	0.025	NA	A*, E*
			25 - 3000	0.025	NA	A*, E*
633 - 980	Collimated	1.0	NA	1.403	0.403	A, B, C, D*, E
		1.5	NA	1.769	0.269	A, B, C, D*, E
		2.5	NA	2.661	0.161	A, B, C, D*, E
		4.0	NA	4.101	0.101	A, E
633 - 980	Focused**		25 - 1000	0.025	NA	A, B, C, D*, E
			25 - 1500	0.025	NA	A, B, C, D*, E
			25 - 2000	0.025	NA	A, B, C, D*, E
			25 - 3000	0.025	NA	A, E

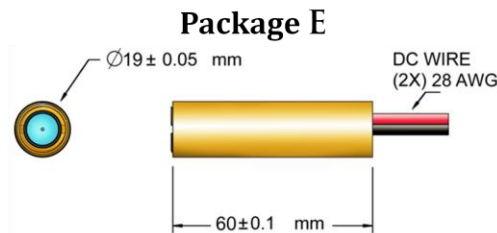
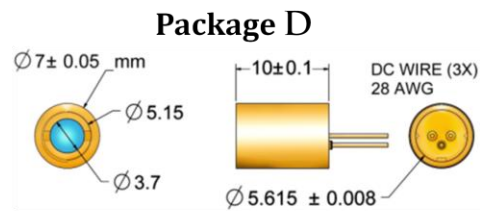
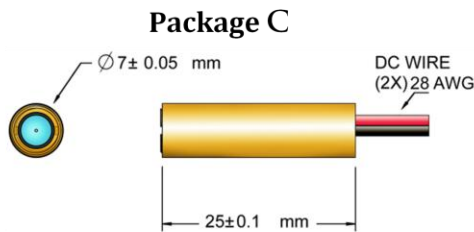
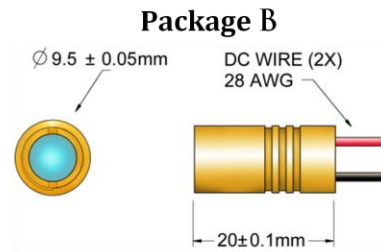
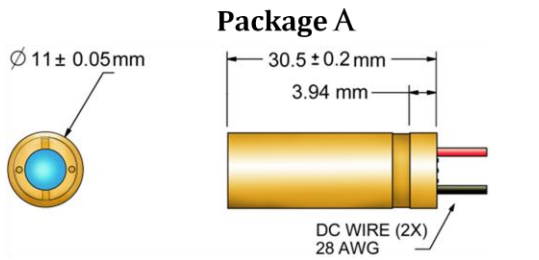
* NOT AVAILABLE W/DRIVER OR VARIABLE POWER ADJUST OPTIONS

** SPECIFICATIONS WILL VARY, DEPENDING ON EXACT OPTICAL DESIGN & CONFIGURATION - CONTACT SALES

Package	Size (mm)	Laser Diode TO Can (mm)	Comment
A**	11 x 30	3.8, 5.6, 9	LD driver & variable power options available
B	9.5 x 20	3.8, 5.6	LD driver & variable power options available
C	7 x 25	3.8, 5.6	LD driver & variable power options available
D	7 x 10	3.8, 5.6	No laser driver available in this package
E**	19 x 60	3.8, 5.6, 9	LD driver & variable power options available

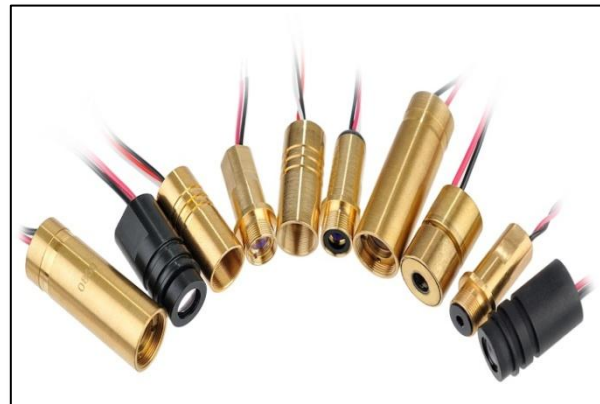
** THESE PACKAGES SIZES REQUIRED FOR 4MM COLLIMATED BEAM

MECHANICAL SPECIFICATIONS:



CONFIGURING THE MINILASE

Blue Sky Research can cooperatively work with your staff to develop custom laser products, from simple to complex. We can Co-Engineer turn-key EO-laser systems to fully integrate into your unique OEM application or build a simple MiniLase laser module. We have a talented staff of engineers who are able to discuss the details and trade-offs of specifications, prototypes, custom configurations and designing/building custom optical components and subsystems to meet your application specific needs.



ORDERING INFORMATION

MINI – Xxx – Xxx – RS – YZ

Xxx – Wavelength

Xxx – Power level(mW), 000 to 999

R – Beam size (mm), a,b,c,d

a=1.0mm, b=1.5mm, c=2.5mm and d=4.0mm

S- Beam Output; F = focused C = collimated

Y - Mechanical package a,b,c,d

a= 11x30mm*, b= 9.5x20mm**, c=7x25mm, d= 7x10mm , e=19x60

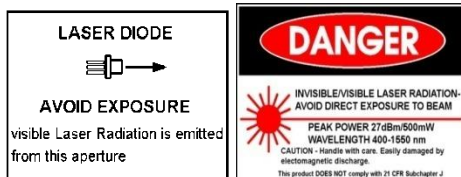
Z - Electronic options

w= wire leads, n= no driver, l= 3wire (adjustable power), c = specified connector

* Driver electronics not available in 7 x 10mm package

** 3 Wire (adjustable power) option not available in 7 x 10, or 7 x 25mm package

Note: 9mm TO can lasers work with 11mm diameter or larger package sizes



This component does not comply with the Federal Regulations (21 CFR Subchapter1) as administered by the Center for Devices and Radiological health. Purchaser acknowledges that his/her products must comply with these regulations before they can be sold to a customer. The output light from laser diodes is harmful to a human body even if it is invisible. Avoid looking at the output light of a FiberTEC directly or even indirectly through a lens during operation. Observance of operation should be through a TV camera or related equipment. Refer to IEC 825-1 and 21 CFR 1040.10-1040.11 as a radiation safety standard for laser products. Blue Sky Research follows a policy of continuous improvement. Specifications are subject to change without notice.