Mini*Lase*™

OEM Laser Modules

Medical Instruments
Machine Vision
Alignment & Targeting
Manufacturing
Instrumentation
Life Sciences
3D Imaging
Sorting & Inspection

When Performance Matters

Blue Sky Research

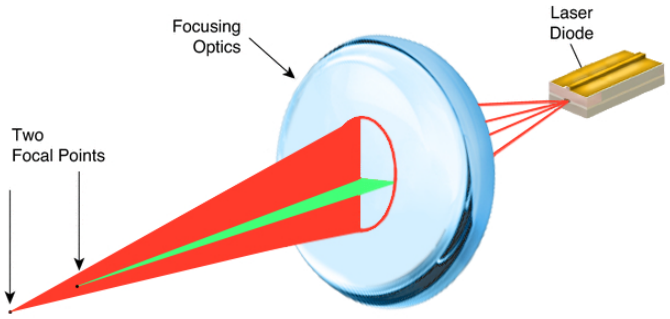
When Performance Matters

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 Mini*Lase*™ *Family of lasers* from Blue Sky Research is designed to offer superior beam qualities in a compact package for OEM applications. The Mini*Lase*™ products combine Blue Sky Research's VPSL™ (Virtual Point Source Laser) with high quality optics, solid packaging technologies and laser drive electronics. The Mini*Lase*™ 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.

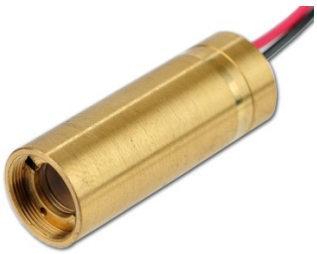
SPECIFING PERFORMANCE, A variety of system parameters need to be considered before you can determine whether a customized module or higher-level assembly is required. Understanding your system, and its optical performance requirements can often be a challenging task. In our experience, the optical beam properties of astigmatism, beam profile, beam waist, and 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 axes (vertical and horizontal) do not coincide. Because of the astigmatism, a single 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.



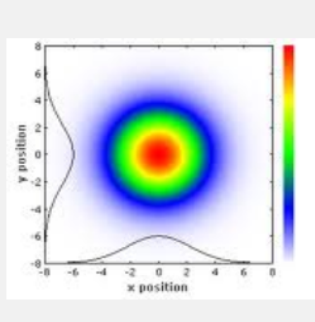
The diagram above illustrates the problems of astigmatism, and how it can limit your optical system performance in terms of focused beam shape and size. If precise beam placement or a small, focused image is required by your system, correcting astigmatism will improve your system performance.

Mechanical Packaging



The housing is the outer case that protects all the components of the Mini*Lase*™ module. Our housings are made from milled brass or anodized aluminum, and are available in several sizes, and mounting options, please see the 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 may result in unstable beam parameters. Often the non-anodized brass housing may be electrically hot. This is determined by pin-out of the diode.

Beam Profile and Beam Shape

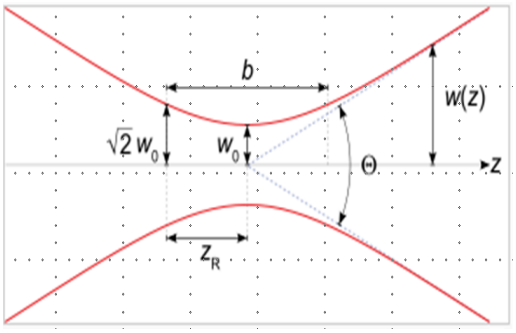


Mini*Lase*™ products often utilize our microlens (µlens™) technology to gain distinct performance advantages over traditional laser diode based modules using anamorphic prism pairs or beam circularizing apertures. The µlens™ technology transforms a standard laser diode's elliptical beam profile and astigmatism into a Gaussian-circular beam profile with corrected astigmatism with no power loss.

At this point, the Mini*Lase*™ can incorporate a high-quality doublet or aspherical lens to collimate or focus the beam, while maintaining its Gaussian, diffraction-limited quality. Mini*Lase*™ collimation or focusing optics enable a precise match to your beam size, shape and waist location system requirements.

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 increases the beam waist depth of focus (*b* in diagram below). Optical system with larger "Beam Waist Depth of Focus" specifications allow system designers to minimize optical system tolerances, relax specifications on all associated opto-mechanical assemblies and simultaneously enable superior optical performance.



b = Beam Waist Depth of Focus
W(z) = Beam Radius
W_0=smallest possible beam radius 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	~90%	Large	Good
LD + Lens	Elliptical, Gaussian	15-30 um	Low	~80%	Moderate	1-20% of power in side lobes
Beam Circularizing Apertures	Near Field Circular, Non-Gaussian	Correction requires lens	Medium	20 - 40%	Low	Side Lobes and diffraction rings

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

Wavelength & Power Options

Wavelength (nm)	Diode Power (mW)								
405	20	40	100						
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 (V_{cc}) stability, care should be taken in designing stabile electrical circuits. To ease electrical design requirements, our Mini*Lase*™ drivers operate from 3.3V - 5V, and 26 AWG is standard. Defined optical power levels are typically set at factory. If your system requires variable power, a separate analog input power option is available which allows V_{cc} voltage (laser power output) to be adjusted.

Mini*Lase*™ brass mechanical packages often 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 Mini*Lase*™ modules be mounted to a heat sink, and it is required & essential for proper operation of all higher power Mini*Lase*™ 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 (Brass)	Anodized Aluminum for case neutral
Operating Temperature	0-50 °C 0-60 °C	All laser diode wavelengths 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	
Power Stability	1hr, <1%	At stable temperature
Beam Diameter Tolerance	+/- 25%	Beam size is the diameter measured at $1/e^2$ max power level at the exit aperture of module
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 Options:

Wavelength (nm)	Beam Characteristics					
	Profile	Beam Dia @ waist (mm)	Focus Distance (mm)	Minimum Beam Diameter (mm) at focus**	Beam Divergence @405 or 633nm (mrad)**	Package Style
405 - 520*	Collimated	1.0	NA	1.66	0.66	A*, E*
		1.5	NA	1.98	0.48	A*, E*
		2.5	NA	2.86	0.36	A*, E*
		4.0	NA	4.3	0.30	A*, E*, F
405 - 520*	Focused**	NA	25 - 1000	0.025	NA	A*,E*,F
		NA	25 - 1500	0.025	NA	A*,E*,F
		NA	25 - 2000	0.025	NA	A*,E*,F
		NA	25 - 3000	0.025	NA	A*,E*,F
633 - 980	Collimated	1.0	NA	1.95	0.95	A, B, C, D*, E
		1.5	NA	2.20	0.70	A, B, C, D*, E
		2.5	NA	2.98	0.48	A, B, C, D*, E
		4.0	NA	4.40	0.40	A, E, F
633 - 980	Focused**	NA	25 - 1000	0.025	NA	A, B, C, D*, E, F
		NA	25 - 1500	0.025	NA	A, B, C, D*, E, F
		NA	25 - 2000	0.025	NA	A, B, C, D*, E, F
		NA	25 - 3000	0.025	NA	A, E, F

***** Not available w/Driver or variable power adjust options

****** specifications will vary, depending on exact optical design & configuration - Contact Sales

MiniLase ™ Packaging Options:

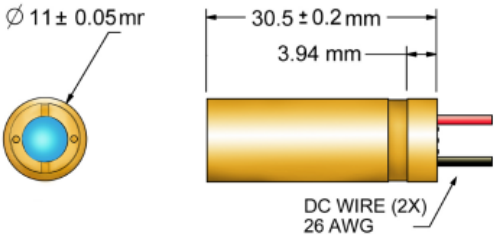
Package	Size (mm)	Laser Diode TO Can (mm)	Comment
A**	11 x 30	3.8, 5.6, 9	LD driver & variable power options available
B	9.5 x 20	3.8, 5.6	LD driver & variable power options available
C	7 x25	3.8, 5.6	LD driver & variable power options available
D	7 x 10	3.8, 5.6	No laser driver available in this package
E**	19 x 60	3.8, 5.6, 9	LD driver & variable power options available
F**	14 x 43	3.8, 5.6, 9	LD driver, variable power & Variable focus options available

** These packages sizes required for 4mm collimated beam

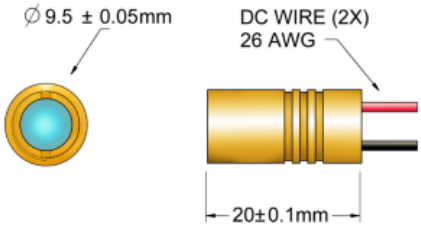
MiniLase ™ Mechanical Specifications:

The standard Mini*Lase*™ packages are shown below. Blue Sky Research can also make custom packages sizes, layouts or configurations to suit your OEM needs.

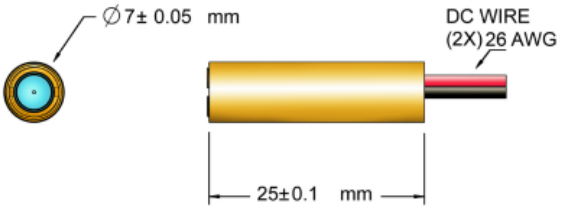
Package A



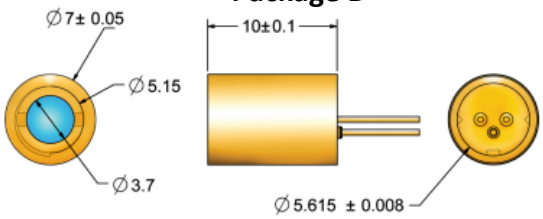
Package B



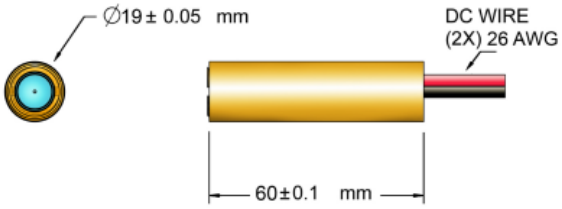
Package C



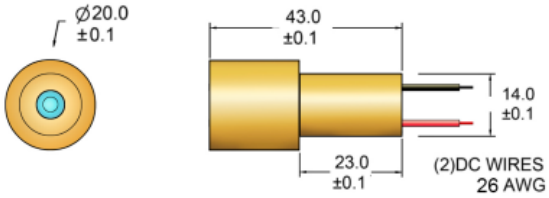
Package D



Package E

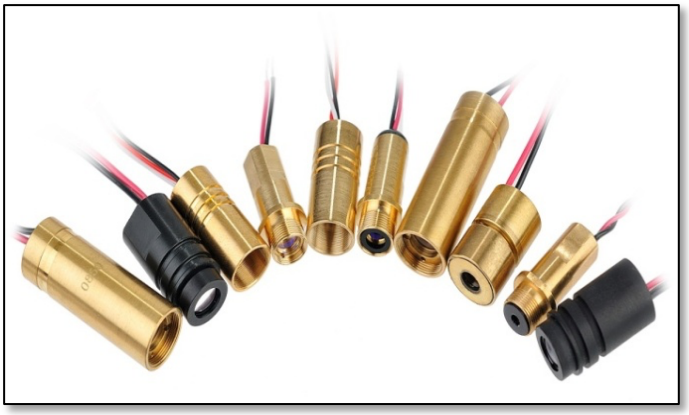


Package F



Configuring the MiniLase ™

Blue Sky Research can cooperatively work with your staff to develop custom laser products, from simple to complex. Our staff of engineers can discuss the details and trade-offs of specifications, prototypes, custom configurations and subsystems which meet your application specific needs. Please contact our sales team at sales@blueskyresearch.com to discuss your specific needs.



MiniLase ™ 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,e,f
A= 11x30mm*, B= 9.5x20mm, C=7x25mm, D= 7x10mm , E=19x60mm, F= 11x43mm*****
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**
***** Focus adjustable package (F) will work with 5.6mm or 9mm TO can sizes**

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

Blue Sky Research is an ISO 9001:2015 certified company

Products are RoHS 3 Compliant

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, laser diodes come in a variety of wavelength and power levels and range from Class 1 to Class 4. Avoid looking at the output light of a laser directly or even indirectly through a lens during operation. Observance of operation should be through a TV camera or related equipment. Refer to IEC 60825-1, IEC 60601-2-22:2007 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.