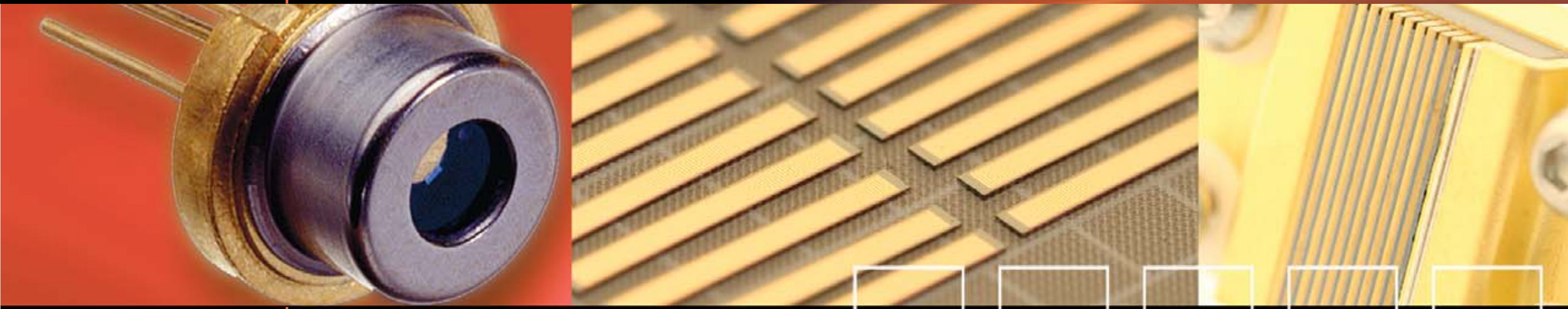
intense **How To Select Series**



Guide to Custom High Power Laser Diodes

You are designing a product that incorporates a high power laser diode. The first question to ask is, “Do I need a custom design?” Beyond that, you need to understand the costs and technical issues involved in customizing diodes. Where do you start? Who understands how to navigate the development process?

This ***Guide to Custom High Power Laser Diodes*** provides product designers with insights, technology tips, and reference materials for specifying custom diodes. This guide will help you speed up the design process, lower costs, and make the process of working with laser diode manufacturers a bit less painful!

- Guidelines for Laser Diode Specifications
- Finding the Right Diode Manufacturer: The Importance of Flexibility
- QWI Enabled: Driving the Development of Next Generation Systems
- Major Semiconductor Laser Materials and Wavelengths
- Laser Applications
- Wavelengths
- Periodic Table of the Elements

intense QWI™ enabled

intense

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GUIDELINES FOR LASER DIODE SPECIFICATIONS

While some design engineers know exactly what they need from their laser diode, others may choose a partner to navigate what can be a complex development process. Laser diode manufacturers know which specifications have the greatest impact on costs and can help you find the most cost-effective solutions for your application.

In the interest of meeting your needs and ensuring a successful project, a good laser diode manufacturer should be willing to explain why some wavelengths are less expensive than others, when one package is more appropriate than another, and why testing is critical before committing to a production order.

Figure 1. High power laser diodes.

For example, the high power laser diodes shown in Figure 1 need thermally compatible heat sinks that may compromise package size. Contacting the diode manufacturer early in the design process can save time, money, and frustration.

Find a supplier with the expertise to produce the lasers. The supplier must have the flexibility and knowledge to customize a product and the capability to manufacture it in the volumes needed. Developing close, interactive communication with a supplier willing to provide one-on-one service is a must.

Figure 2 shows the 10-step process that will help you determine your laser diode needs and your supplier's ability to meet those needs.

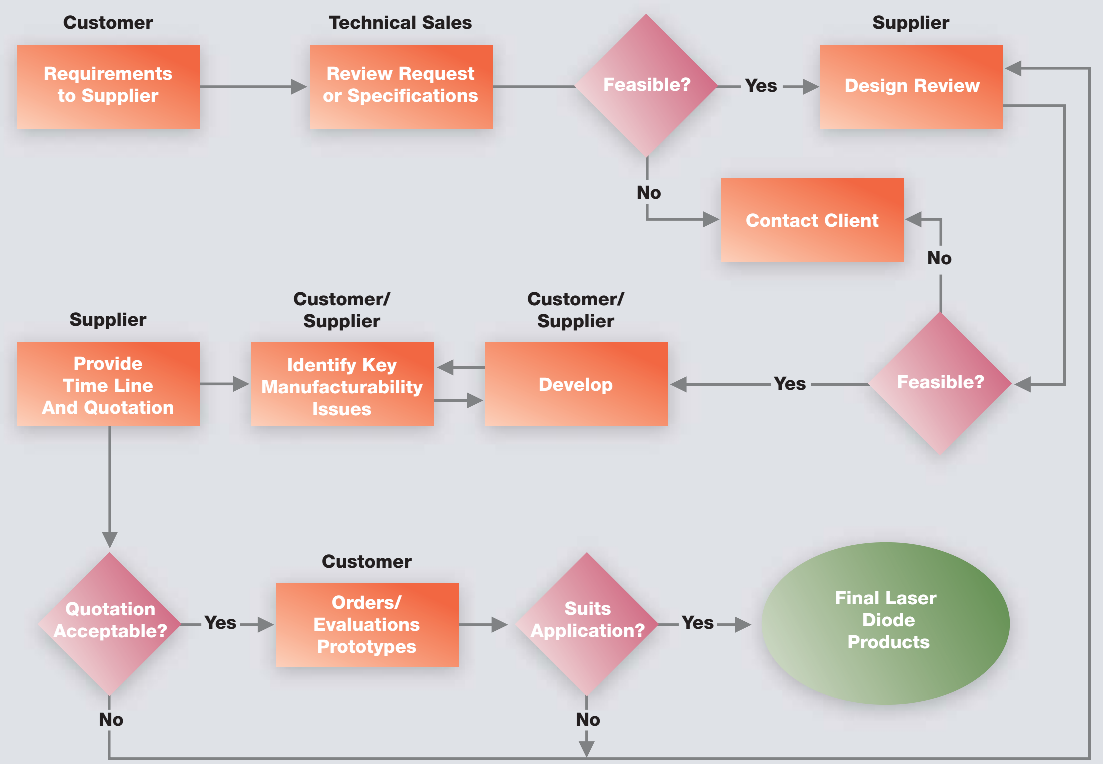


Figure 2. 10-step process for determining your laser diode needs.

Design Considerations

The design and prototyping process can be quite involved. It may require extended and close interactions with the diode manufacturer when establishing basic design needs. Issues to discuss include performance levels, product lifetime, special environmental testing, delivery schedules, drawings, spec sheets, source and quality inspections, and budgets. These requirements are preliminary and can change as you work with the manufacturer to balance the whole package of specifications to fit the application. This balance, necessary for a cost-effective and reliable product, happens only if your supplier can describe the potential trade-offs.

Avoid open packages.
Open packages are space-efficient and easily accessible, but they leave the fragile laser exposed to contamination and mechanical damage. Most suppliers will not guarantee open packages because the possibility of damage is so great. Sealed packages protect the device from mechanical damage and provide a particle-free and dry atmosphere for the laser.

Consider active temperature control.
An increase of 10°C may reduce a laser's lifetime by 50 percent. Many sudden and longer term failures have been traced to inadequate laser cooling. Passive cooling can be appropriate for some big applications, but even then an engineer should determine the temperature under worst-case conditions and plan appropriately.

Always use laser drivers with the appropriate protection.
The most common cause of failure in laser diodes is current transients. Look for well-qualified commercial laser drivers. Testing and constructing a custom driver requires expertise and specialized equipment to ensure that the driver adequately protects the laser under all conditions. Electrostatic discharge, usually caused by poor handling techniques, also plays a large role in laser diode failure. Anyone working with laser diodes must be thoroughly familiar with techniques for preventing this problem.

Operate the device at rated or lower output.
Standard-brightness laser diodes may emit as much as 4 to 5 W per 100 um of aperture, depending upon wavelength; high-brightness devices may emit twice as much or more for the same stripe length. However, increasing brightness increases cost and may affect lifetime. Many OEMs who use devices in critical applications operate them below the rated power. In lower duty cycle applications, it may be possible to exceed the rated power, but one should assess the reliability consequences beforehand.

Use standard wavelengths and loosen tolerances where possible.
Most manufacturers produce devices that cover a definitive wavelength range. Within this range, some wavelengths will be more commonly available than others and are more likely to be in stock. For example, a company's lasers might cover the range from 635 to 980 nm, with standard device wavelengths at 635, 650, 670, 785, 808 830, 910, and 980 nm (see Figure 3). If an application demands a special wavelength, it may require growing a custom wafer, which can add costs of $10,000 to $30,000.

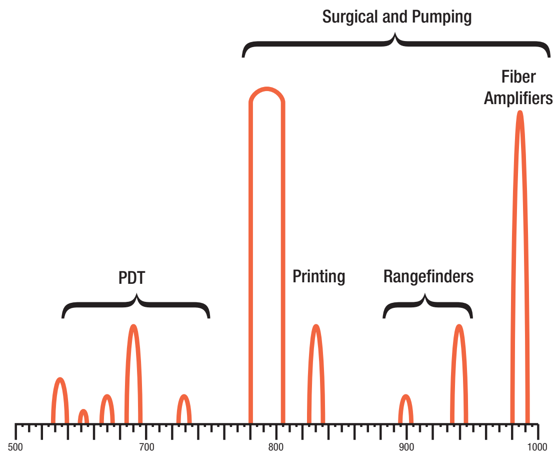
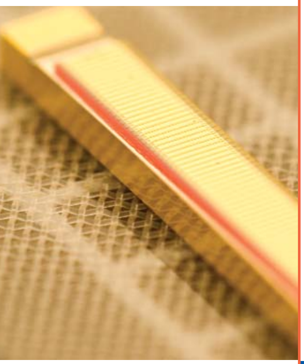


Figure 3. Wavelengths are offered across the spectrum.

Use standard packages.
The industry has developed a number of standard packages, including C-mount, TO-3, and HHL, and each laser diode supplier has test and burn-in fixtures designed for them. Using standard packages reduces cost and delivery times because the supplier doesn't need to pass on extra expenses of custom fixturing. Moreover, custom packages typically require three- to four-month lead times and may also require an investment in custom tooling. In large quantities, however, custom packages are not necessarily much more expensive than the standard ones. Finding a package supplier willing to do custom work is another issue.



Don't specify characteristics that are hard to control.
Some characteristics, such as tight wavelength tolerance uniformity, are difficult to control during wafer growth. The 808 nm diodes used to pump solid-state lasers typically have ±2 or 3 nm center wavelength tolerances: a tighter tolerance will increase the cost substantially. The supplier works from wafers with some non-uniformity. Entire units must be assembled and burned in before being screened to meet the wavelength specification. In this case, the supplier bases prices on costs relating to estimated yields. Remember, tight specifications translate to higher product costs. It is more cost-effective to provide for wavelength tuning by temperature than to require a specific wavelength.

Consider active alignment for tight positional tolerances.
In general, passive alignment is desirable. But specifying positional tolerances of less than 100 μm results in two problems: alignment requires special fixturing, and the device usually requires a custom package (standard packages may have machining tolerances of up to ±125 μm). In many cases, active alignment can be more practical for systems with tight positional tolerances. Once again, tighter specifications mean higher product costs.

Don't overspecify spatial output.
Specifying the spatial output as power into an ∫number of some full width half maximum is far less costly than specifying a shape. Don't specify profiles or near-field patterns unless absolutely necessary. Many spatial characteristics are difficult for the manufacturer to control. This creates additional costs through the screening process and yield losses.

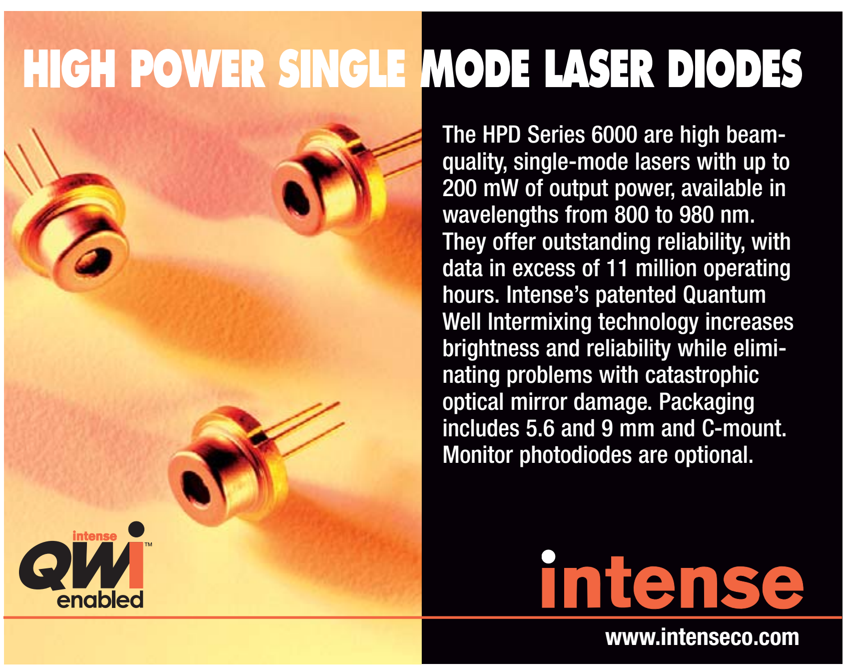
Specify only requirements that are important to the application.
Unnecessary specifications always raise the final cost of the product because the manufacturer must test each quantitative specification for compliance.

Prototype Considerations

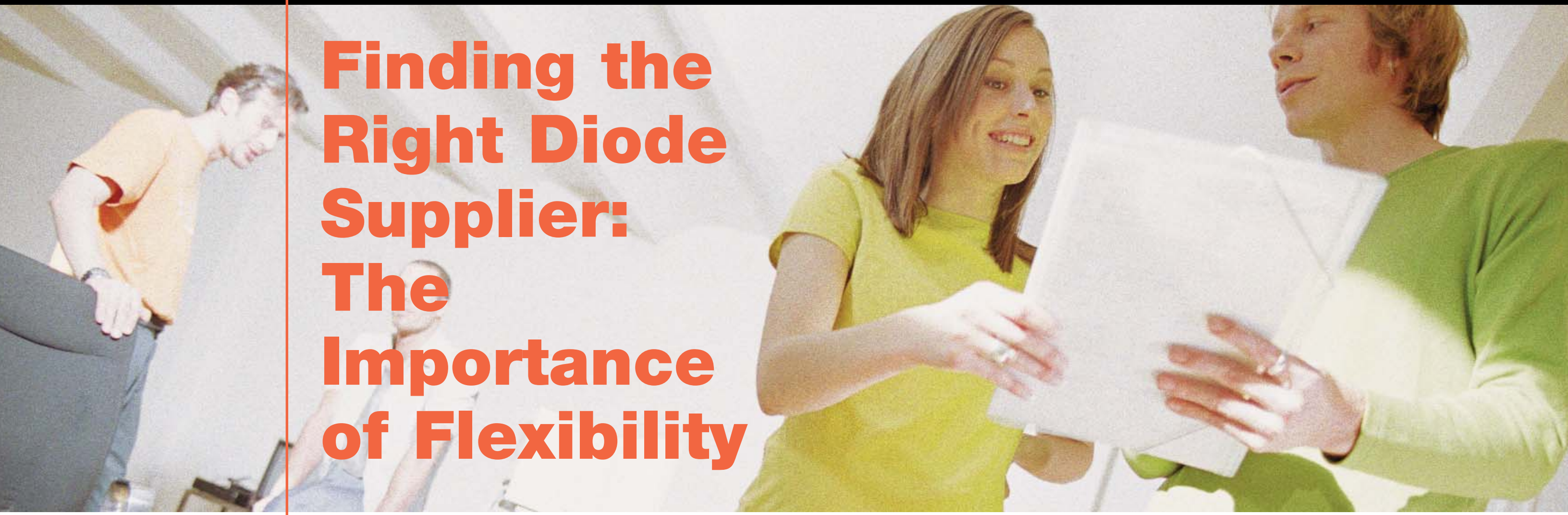
Always verify operation using prototypes that cover the specification extremes.
During the prototype test phase, it is not uncommon to discover that specifications need modifications. For example, the coupling efficiency through an optical system can often vary considerably from the theoretically calculated values. This type of production surprise is best discovered before total commitment.

Check a significant number of evaluation samples before committing to production.
In one case, a customer bought one prototype device that worked well in his system. He then ordered 1000 diode lasers. After installing the first 100 in his system, he discovered that the tolerance for one parameter was set too wide, resulting in a 50 percent yield. A new specification required modifying the material. Besides paying for the new devices, the customer had to pay for those in his original order. Sufficient prototype testing could have prevented this problem.

Partner with your suppliers.
Sharing proprietary information requires trust. Laser diode manufacturers are accustomed to handling proprietary information and, in many special laser applications, sharing of information is mutual. The supplier and the OEM must communicate freely to minimize costly errors.



Repeated iterations in developing custom devices are not uncommon. An OEM who understands the supplier's position, communicates effectively with the supplier, and takes advantage of the supplier's expertise will be able to make the custom development process as efficient and as cost-effective as possible. QWi



Finding the Right Diode Supplier: The Importance of Flexibility

When contacting a supplier, be ready to explain what is special about your requirement. If the OEM product engineer isn't sure what is needed, the supplier's application engineer can help determine whether it is likely to involve customization and to what extent. The project may require custom or specialized wafer growth, spectral characteristics, packaging, and budgetary as well as environmental/thermal considerations.

Talking over a project is easier if each party understands the other's thinking. The customer wants to get a job done. The diode manufacturer wants to figure out whether the project will eventually transition to medium or high volume production quantities. Suppliers must gauge financial as well as opportunity costs of projects against the size of non-recurring engineering (NRE) charges a customer's budget can absorb and the long-term ROI from projected future production revenue streams.

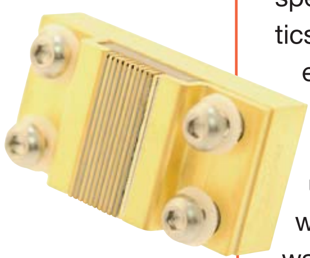
The expertise and core competency of the supplier is important. Suppliers are aware of their own strengths and will accept projects that fit their expertise. Flexibility also plays a large role. Many companies gear their operations around standard product assembly line practices and cannot easily accommodate custom projects.

Custom suppliers can provide a rapid response and are willing to take on more specialized projects. Flexibility and one-on-one service are major advantages.

Volume is another factor in screening projects. Although there are large variations in product process, depending upon the volume, one can make some broad generalizations. If the project requires:

- One or two custom pieces for experiments will most likely result in engineering samples that include NRE amortized in the pieces and will result in a premium price for the samples. This will allow the manufacturer to recoup the costs of producing the custom product.
- If a customer is willing to place orders for ten to one hundred pieces for the same custom project, the manufacturer can amortize the NRE charges across the increased volume and offer the customized product at a lower price.
- With ten to hundreds of prototype devices and an expectation for full production later, custom wafer growth may be possible with costs amortized over prototype and production devices. Although custom package design is possible, standard packages are still more reasonable at this volume.
- Production quantities of hundreds to thousands of units over 12 -18 months, custom wafer growth and custom packaging become economical.

When all is said and done, you need a balanced supplier, one who can handle custom projects as well as standard products. Flexibility and one-on-one service can be major advantages. QWi



Hermes™
High Power Laser Diodes

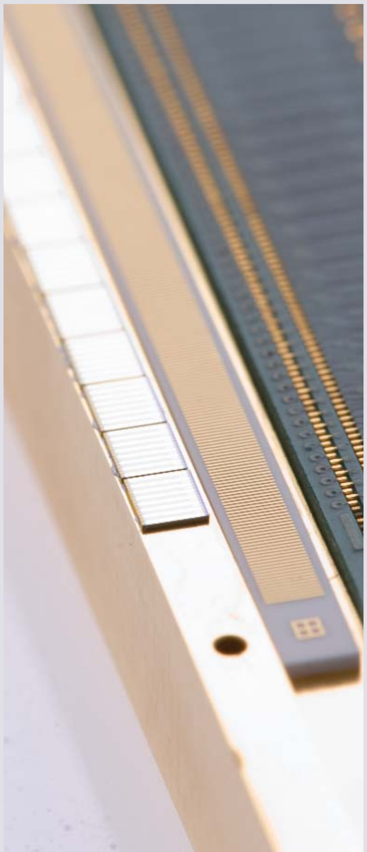
The Hermes family of High Power Laser (HPL) diodes is designed for use in a wide range of aerospace, defense, pump source, and materials processing applications.

Intense's patented QWI design process allows the HPL products to deliver superior power, unrivalled brightness, and high reliability and efficiency. Single emitters, conductively cooled packages, and micro channel cooled packages are available as standard products. These same packages can also be fiber coupled. Hermes lasers operate reliably in both continuous wave (CW) and quasi-continuous wave (QCW) modes.

Driving the Development of Next Generation Systems

The latest advances in diode laser technology are driving the development of next generation systems. Through advanced semiconductor design and patented Quantum Well Intermixing (QWI) technology, Intense is delivering laser products with superior brightness, longer lifetimes, and increased reliability. The company's new Quantum Well Intermixing process is revolutionizing the way lasers are solving mission critical applications by producing integrated chips at performance levels and yields previously unseen in the industry.

QWI is an integration technology that allows the properties of a semiconductor quantum well structure to be modified after growth. The process combines active and passive components on the same chip. Intense's proprietary QWI technology is used to fabricate complex laser diodes, laser diode arrays, and photonic integrated circuits in a production environment. The end result is next generation laser technology that is easily incorporated into a wide range of applications.



QWI Technology Delivers Innovation

Intense's patented Quantum Well Intermixing (QWI) process is setting new standards for semiconductor laser performance, reliability, and manufacturability.

Smaller Form Factor, More Flexible Packaging

QWI technology enables the integration of passive regions at the facets of laser emitters, arrays, and bars. This allows for the development of small form-factor, cost effective, and extremely versatile optical systems. The disruptive nature of Intense's revolutionary QWI laser technology dramatically changes the dynamics of existing products and, at the same time, creates whole new market segments that require the precise delivery of optical energy – in defense, imaging, marking, and industrial markets.

Intense's QWI process is also a powerful tool for integrating multiple semiconductor components into complex, monolithic photonic integrated systems. Examples include both active devices (such as optical amplifiers and modulators) and passive components (including low-loss waveguide interconnects, splitters, and couplers).

Impurity Free Process

A number of QWI techniques

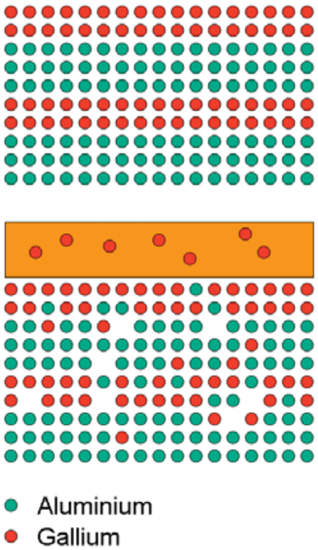


Figure 1. (a) As-grown GaAs/AlAs quantum well structure. (b) Same structure after quantum well intermixing using impurity-free vacancy disordering.

have been developed by various companies, including impurity-induced, implantation-induced, and laser-induced intermixing. Intense's approach, which avoids introducing electrically active dopants, provides superior results as no optical absorption is allowed within the intermixed area.

Intense makes use of dielectric caps on the surface of the semiconductor to create vacancies on the group III lattice site. The vacancies diffuse through the semiconductor and, as a result, individual atoms hop from one lattice site to another. This enables the quantum well to intermix with the adjacent barrier material.

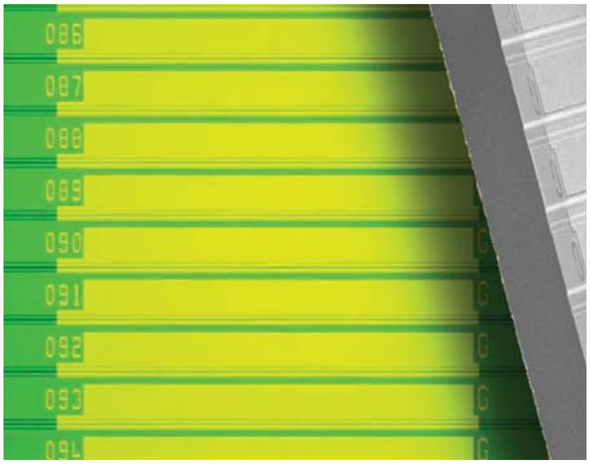


Figure 2. QWI enabled laser array with passive waveguides in the facet regions.

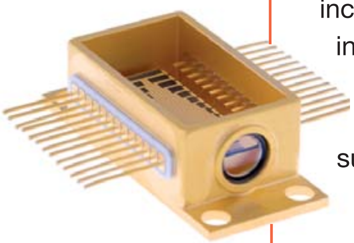
This can best be understood by looking at the QWI of a GaAs quantum well with AlGaAs barriers. Because the central GaAs layer is narrow, the electron and hole levels are quantized; therefore, the effective bandgap is wider than that of bulk GaAs. Intermixing causes Al to diffuse into and Ga out of the well, modifying the shape of the well and increasing its average bandgap. As the bandgap energy of the intermixed QW is now greater than that of the original well, the intermixed structure can be used as a passive waveguide with very low loss. The end result is significant gains in component reliability, optical performance, and manufacturability.

Revolutionary Laser Reliability

The power and reliability of a typical laser device are fundamentally limited by absorption in the facet region, giving rise to Catastrophic Optical Mirror Damage (COMD). A related major issue with conventional high power lasers is filamentation, which creates a hot-spot on the laser facet, limiting the optical power and causing COMD.

In response to the more sophisticated requirements of today's markets, Intense has developed its QWI processes to create active and passive sections in the same laser cavity. Passive waveguides are located at the laser facets to form Non-Absorbing Mirrors (NAMs), passivating the facet regions of the laser. Semiconductor lasers with NAMs have been shown to operate at much higher powers than conventional devices. For example, a dramatic improvement in single mode power can be achieved by including NAMs with a large QWI shift such that the risk of COMD is negated, giving a high performance single mode laser that can operate at enhanced optical power (>1 W) with exceptional reliability. By comparison, a conventional laser without NAMs suffers COMD at low optical power.

The Intense QWI process has created a new standard for reliability and performance of semi-



INSlam™
Individually Addressable Laser Array Modules

The INSlam™ family of laser products is revolutionizing the delivery of laser energy, reducing complexity and delivering unrivalled cost savings and significant reliability increases for materials processing and imaging/illumination systems.

Each module contains individually addressable single mode or multimode lasers arrays of up to 100 emitters on one monolithic chip. Depending on need, drive electronics, optical monitoring, and micro and/or macro optics are incorporated allowing a single compact unit to replace a much larger, more complex traditional sub-system. Whatever the configuration, Intense's patented QWI design process provides unparalleled performance and reliability.

conductor laser diodes. In excess of 20 million total emitter hours have been collected at high optical powers. The exceptional lifetime enables very large monolithic arrays of up to 100 laser elements to be manufactured with per emitter lifetimes measured in millions of hours in continuous wave (CW) or pulsed operation.

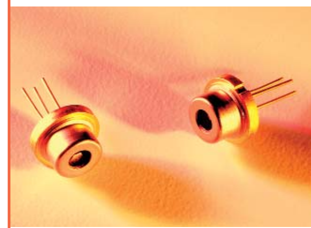
High Yields Mean Lower Costs, Ready Availability for OEMs

The NAM regions have low optical loss and are fabricated so they occupy a significant fraction of the length of the cavity. This relaxes cleave tolerances during fabrication, enabling a high yield manufacturing process. Large arrays of up to 100 single-mode lasers can be integrated onto a single chip with excellent laser parametric uniformity. This guarantees virtually unlimited availability of high performance, lower cost lasers to meet any size production run.

These large, multi-element laser chips, together with drive ASICs and micro-optics, form the building blocks of complex optical systems, all packaged inside robust, small form-factor modules.

Exceptional Uniformity, Beam Control, & Brightness

NAMs bring strong advantages to applications that require exact beam control, including high precision printing. The facet regions remain relatively cool during operation, providing an exceptionally well-controlled single mode beam, both in terms of spot size and pointing stability. Such advanced emitters and arrays enable the development and manufacture of a new generation of high resolution printing devices. In addition, the combination of QWI and Intense's novel epitaxial designs produces lasers with the high brightness needed to meet the demanding needs of a wide range of defense, imaging, and industrial applications. QWI



Series 6000
QWI Enabled High Brightness Single Mode Lasers

The **Series 6000** are very high brightness, single mode 830 nm lasers with up to 200 mW of kink-free power. These high beam quality lasers have low astigmatism and a Gaussian far field. These are ideally suited for defense applications such as targeting, rangefinding, and illumination applications.

Major Semiconductor Laser Materials and Wavelengths

MATERIAL	WAVELENGTH RANGE	COMMENTS
GaN	405-450 nm	Commercial applications
ZnCdSe	490-525 nm	Laboratory applications
AlGaInP/GaAs	620-680 nm	Commercial applications
Ga0.5In0.5P/GaAs	670-680 nm	Commercial applications
GaAlAs/GaAs	750-870 nm	Commercial applications; works at shorter wavelengths but short-lived
GaAs/GaAs (pure)	904 nm	Commercial applications
In0.2Ga0.8As/GaAs	980-1050 nm	Strained-layer, commercial
InGaAsP/InP	1100-1650 nm	Commercial applications
PbCdS	2.7-4.2 µm	Requires cooling
PbSnTe	6.5-20 µm	Requires cooling
PbSnSe	8-30 µm	Requires cooling

Source: Hecht, Jeff, Understanding Lasers, John Wiley & Sons, 2001.

Laser Applications

Military & Defense

- Target designation/illumination
- Night vision
- Rangefinding
- Weapons simulation
- Active optical target detection
- 3D LIDAR imaging
- Counter measures/force protection
- Ordinance initiation/detonation

Industrial

- Solid state pump sources
- Fiber laser pump sources
- Direct diode materials processing
- Automotive sensors
- Machine vision
- Measurement sensors

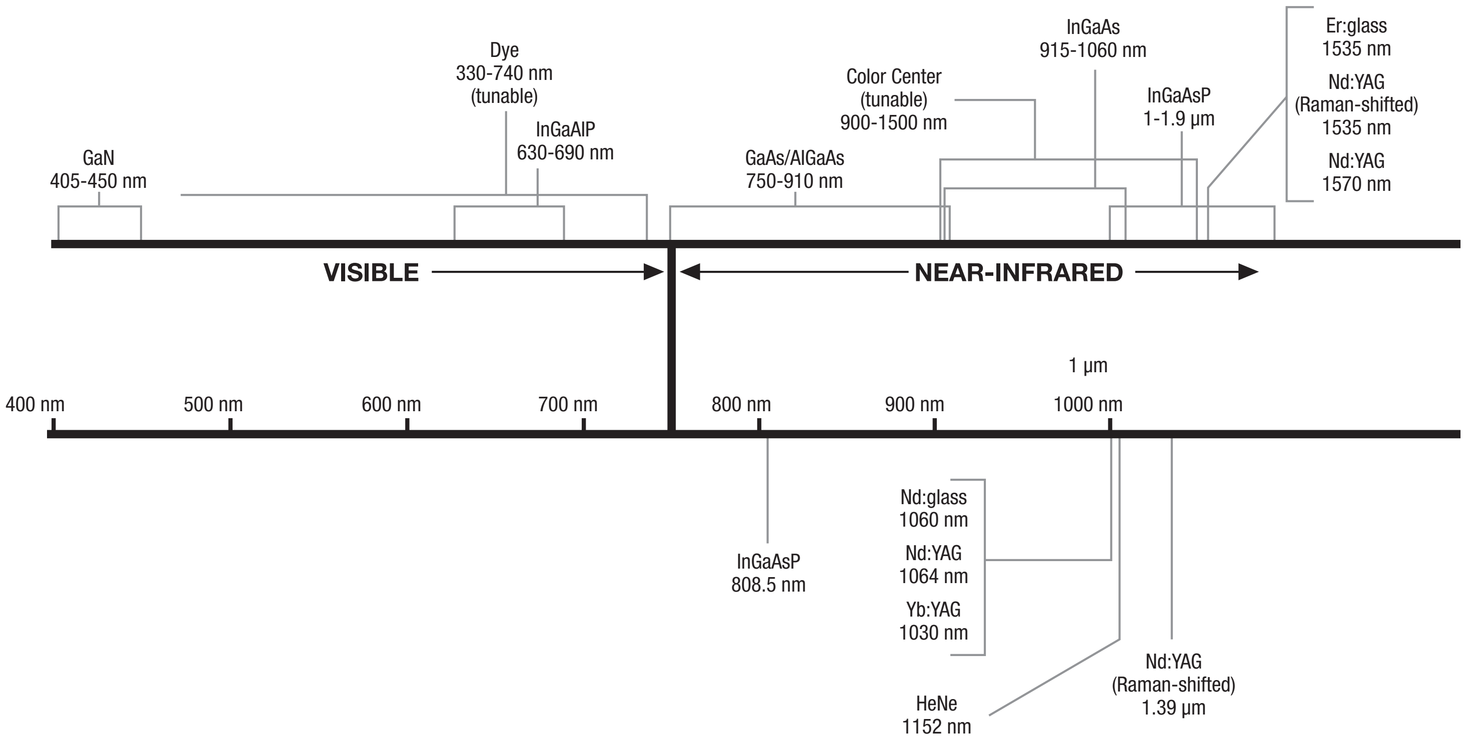
Medicine/Science

- Dentistry
- Surgery
- Sterilization
- Photo Dynamic Therapy (PDT) drug activation
- Tumor detection (CTLM)
- Low level laser therapy
- Hair removal
- Skin resurfacing
- Raman spectroscopy
- Material/tissue fluorescence

Print & Imaging

- Thermal computer to plate
- Commercial color devices
- Flexographic devices
- Commercial quality printing
- On-demand output
- Personalized printing

Wavelengths



Periodic Table of The Elements

Name of element
Atomic number
Chemical symbol
Relative atomic mass †

- Alkali metals
- Alkaline earth metals
- Lanthanides
- Actinides
- Transition metals
- Poor metals
- Metalloids
- Nonmetals
- Halogens
- Noble gases

Group → / Period ↓	1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 VIIIB	9 VIIIB	10 VIIIB	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	hydrogen 1 **H** 1.00794(7)																	helium 2 **He** 4.002602(2)
2	lithium 3 **Li** 6.941(2)	beryllium 4 **Be** 9.012182(3)											boron 5 **B** 10.811(7)	carbon 6 **C** 12.0107(8)	nitrogen 7 **N** 14.00674(7)	oxygen 8 **O** 15.9994(3)	fluorine 9 **F** 18.9984032(5)	neon 10 **Ne** 20.1797(6)
3	sodium 11 **Na** 22.98976928(2)	magnesium 12 **Mg** 24.3050(6)											aluminium 13 **Al** 26.9815386(8)	silicon 14 **Si** 28.0855(3)	phosphorus 15 **P** 30.973762(2)	sulphur 16 **S** 32.066(6)	chlorine 17 **Cl** 35.4527(9)	argon 18 **Ar** 39.948(1)
4	potassium 19 **K** 39.0983(1)	calcium 20 **Ca** 40.078(4)	scandium 21 **Sc** 44.955912(6)	titanium 22 **Ti** 47.867(1)	vanadium 23 **V** 50.9415(1)	chromium 24 **Cr** 51.9961(6)	manganese 25 **Mn** 54.938045(5)	iron 26 **Fe** 55.845(2)	cobalt 27 **Co** 58.933195(5)	nickel 28 **Ni** 58.6934(2)	copper 29 **Cu** 63.546(3)	zinc 30 **Zn** 65.39(2)	gallium 31 **Ga** 69.723(1)	germanium 32 **Ge** 72.61(2)	arsenic 33 **As** 74.92160(2)	selenium 34 **Se** 78.96(3)	bromine 35 **Br** 79.904(1)	krypton 36 **Kr** 83.80(1)
5	rubidium 37 **Rb** 85.4678(3)	strontium 38 **Sr** 87.62(1)	yttrium 39 **Y** 88.90585(2)	zirconium 40 **Zr** 91.224(2)	niobium 41 **Nb** 92.90638(2)	molybdenum 42 **Mo** 95.94(1)	technetium 43 **Tc** [97.9072]	ruthenium 44 **Ru** 101.07(2)	rhodium 45 **Rh** 102.90550(2)	palladium 46 **Pd** 106.42(1)	silver 47 **Ag** 107.8682(2)	cadmium 48 **Cd** 112.411(8)	indium 49 **In** 114.818(3)	tin 50 **Sn** 118.710(7)	antimony 51 **Sb** 121.760(1)	tellurium 52 **Te** 127.60(3)	iodine 53 **I** 126.90447(3)	xenon 54 **Xe** 131.29(2)
6	caesium 55 **Cs** 132.9054519(2)	barium 56 **Ba** 137.327(7)	Lanthanides 57-71 *	hafnium 72 **Hf** 178.49(2)	tantalum 73 **Ta** 180.94788(2)	tungsten 74 **W** 183.84(1)	rhenium 75 **Re** 186.207(1)	osmium 76 **Os** 190.23(3)	iridium 77 **Ir** 192.217(3)	platinum 78 **Pt** 195.084(9)	gold 79 **Au** 196.966569(4)	mercury 80 **Hg** 200.59(2)	thallium 81 **Tl** 204.3833(2)	lead 82 **Pb** 207.2(1)	bismuth 83 **Bi** 208.98040(1)	polonium 84 **Po** [208.9824]	astatine 85 **At** [209.9871]	radon 86 **Rn** [222.0176]
7	francium 87 **Fr** [223.0197]	radium 88 **Ra** [226.0254]	Actinides 89-103 **	rutherfordium 104 **Rf** [263.1125]	dubnium 105 **Db** [262.1144]	seaborgium 106 **Sg** [266.1219]	bohrium 107 **Bh** [264.1247]	hassium 108 **Hs** [269.1341]	meitnerium 109 **Mt** [268.1388]	darmstadtium 110 **Ds** [272.1463]	roentgenium 111 **Rg** [272.1535]	ununbium 112 **Uub** [277]	ununtrium 113 **Uut** [284]	ununquadium 114 **Uuq** [289]	ununpentium 115 **Uup** [288]	ununhexium 116 **Uuh** [292]	ununseptium 117 **Uus** [292]‡	ununoctium 118 **Uuo** [294]

* Lanthanides	lanthanum 57 **La** 138.90547(7)	cerium 58 **Ce** 140.116(1)	praseodymium 59 **Pr** 140.90765(2)	neodymium 60 **Nd** 144.242(3)	promethium 61 **Pm** [144.9127]	samarium 62 **Sm** 150.36(2)	europium 63 **Eu** 151.964(1)	gadolinium 64 **Gd** 157.25(3)	terbium 65 **Tb** 158.92535(2)	dysprosium 66 **Dy** 162.500(1)	holmium 67 **Ho** 164.93032(2)	erbium 68 **Er** 167.259(3)	thulium 69 **Tm** 168.93421(2)	ytterbium 70 **Yb** 173.04(3)	lutetium 71 **Lu** 174.967(1)
** Actinides	actinium 89 **Ac** [227.0277]	thorium 90 **Th** 232.03806(2)	protactinium 91 **Pa** 231.03588(2)	uranium 92 **U** 238.02891(3)	neptunium 93 **Np** [237.0482]	plutonium 94 **Pu** [244.0642]	americium 95 **Am** [243.0614]	curium 96 **Cm** [247.0703]	berkelium 97 **Bk** [247.0703]	californium 98 **Cf** [251.0796]	einsteinium 99 **Es** [252.0830]	fermium 100 **Fm** [257.0951]	mendelevium 101 **Md** [258.0984]	nobelium 102 **No** [259.1011]	lawrencium 103 **Lr** [262.110]

intense High Power Laser Diodes

Featuring Intense's proprietary Quantum Well Intermixing technology

	WAVELENGTH		OUTPUT POWER	QWi enabled
	Standard Wavelength	Optional Range		
INFRA-RED				
CW Components				
Series 1000†	808 nm	750-885 nm	0.5-5 W	
Series 3000†	808 nm		1-3 W	
Series 1100†	980 nm	886-1064 nm	0.1-4 W	
Series 3100†	980 nm		1-2 W	
Series 8000, Series 8100	7xx-9xx nm		2-12 W	Yes
Short Pulse Components				
Series 2100	905 nm	886-1100 nm	5-25 W	
Series 2100-VS	905 nm	886-1100 nm	up to 150 W	
Series 2400	1550 nm	886-1000 nm	5-12 W	
Series 2400-VS	1550 nm	886-1000 nm	up to 48 W	
Single Mode Components				
Series 4000	830 nm		5-50 mW	
Series 6000	8xx nm		100-200 mW	Yes
Series 6100	9xx nm		100-200 mW	Yes
Single Emitter Laser Engine				
Power Core 808	808 nm		4 W	
VISIBLE				
CW Components				
Series 1200	635 nm	630-655 nm	0.25-0.70 W	
Series 1300	670 nm	660-690 nm	0.5-1 W	
Modules				
Power Pack 630	630 nm		2.4 W	
Series 5200†	635-655 nm		1.5-6 W	
Series 5300†	670-690 nm		2.5-10 W	
Systems				
Series 7400	635-650 nm		0.2-2 W	
Series 7400	670-690 nm		0.3-4 W	
BARS & STACKED ARRAYS				
High Power Bars				
Hermes QCW Bar	808 nm		up to 100 W	Yes
Stacked Arrays				
Hermes QCW Stacked Array	808 nm		up to 900 W QCW	Yes
INDIVIDUALLY ADDRESSABLE ARRAYS				
INSlam	8xx, 9xx nm		up to 200 mW	Yes
DLAM	808, 830, 980 nm		up to 160 mW	Yes

†Also available as fiber coupled

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