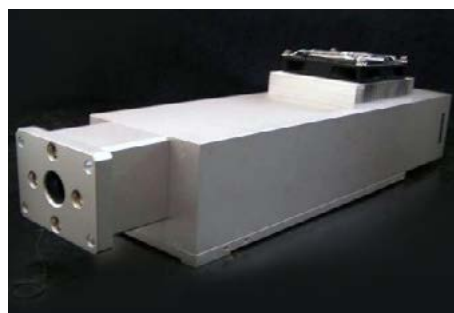


## VCSEL Diode Pump for Solid State Laser

In recent years, the market demand for laser processing has increased due to its inherent advantages and technological development. Diode-pumped solid-state (DPSS) laser has widely drawn market attention due to its narrow pulse widths, high output energy, high peak power, and good material absorption. Take the industrial field as an example, in addition to traditional laser marking, scribing, cutting, drilling, material removal, surface treatment and special material processing applications, the development of new technologies such as additive manufacturing, 3D printing, new display, UV laser marking, etc., further expand the application of solid-state laser.









The 808nm wavelength infrared AlGaAs laser diode is the core component to pump a Nd:YAG or Nd:YVO4 crystal which produces 1064nm wavelength laser. High-energy pulsed DPSS lasers are typically pumped by high-brightness stacks of EEL (Edge Emitting Laser) bars. Recently, pump modules comprising high power 2D VCSEL arrays have emerged as attractive alternatives to pump DPSS lasers. For DPSS lasers, the coupling of light is very important. There are two kinds of coupling, spatial coupling, and fiber coupling. For spatial coupling, the pump source and the substrate can be separated to reduce the production costs and complexity of manufacturing process. For fiber coupling, a fusion splicer is required for welding of optical fibers, which increases manufacturing costs.



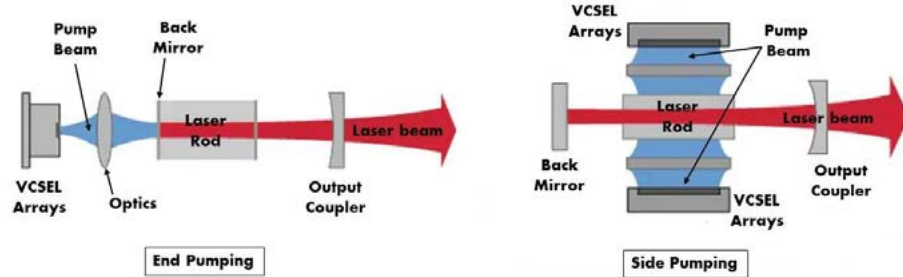
Brightlaser's 808nm VCSELs are suitable for spatial coupling type of 808nm high power DPSS lasers, and the power level can be achieved up to hundreds of watts. Compared with the traditional 808nm EEL pump source, VCSEL has better wavelength stability, the wavelength temperature coefficient is

0.07nm/deg or less while that of EEL is 0.25-0.3nm/deg. Besides, VCSEL has the characteristics of smaller divergence angle and round light spot, which is beneficial for collimation or focusing and simplifies the coupling link, it also helps to reduce costs and improve reliability. Furthermore, VCSEL has the advantages of high reliability, wide operating temperature range, and can better meet industrial requirements of lasers.

Feature	VCSEL	EEL
Beam quality	Best, round, low divergence	Fair, ellipse, asymmetric
Temperature stability	0.07nm/deg	0.25-0.3nm/deg
Spectral width	1nm	1-2nm
Speckle	Low in an array	High
Cost	Low-Medium	Medium-High

Brightlaser's 808nm VCSEL series	
Demonstrate a variety of high power, high efficiency and high beam quality 808nm VCSEL arrays.	
	
VCSEL Chip	VCSEL 3.5mmx3.5mm Package
	
VCSEL 2x5 Arrays	VCSEL 3x3 Arrays
	
VCSEL 5x8 Arrays	VCSEL 5x8 Arrays Module with Water Cooling

High power 2D VCSEL arrays are well suited for side-pumped and end-pumped solid-state lasers such as actively and passively Q-switched Nd:YAG lasers. VCSEL arrays can be arranged in a layout that is optimal for uniform illumination of the gain medium to achieve good beam quality and high energy extraction resulting in a high single-pass absorption. They are well suited for constructing very compact side-pumped solid-state lasers. Furthermore, the chip size and the position of each emitter within an array can be photolithographically defined. The VCSEL array chip can be formed as square or rectangular shape and the emission area within the chip can be of any shape. They are well suited for end-pumped solid-state lasers.



The high efficiency device based on Brightlaser 808nm VCSEL arrays can be applied to 808nm high power vertical stacked semiconductor laser module, and it can also be used in pumping Q-switched Nd:YAG lasers for many industrial, medical, and other applications. Brightlaser can also provide product customization services, such as vertical stacking of multiple laser array bars to form a high-power laser output. High-density laser array bar stacking technology is used with bar spacing being small to enable the module to obtain high-brightness laser output while maintaining a small size and high efficiency.

#### Innovations for Freedom

*Brightlaser was founded in 2014, is a global pioneer supplier in VCSEL technology from components, sensors, to total solutions for AI/IoT applications including Optical Communication, Consumer Electronics, ADAS, Machine Vision, Telecom, Robotics, Smart House, Surveillance System, etc.*

*As a high-tech company, Brightlaser possesses its own VCSEL intellectual properties in wafer design, advanced chip process, and applications. Brightlaser headquartered in Hong Kong, established branch offices in Shen Zhen and Zhong Shan of China. The factory located in Zhong Shan covers footprint of 160,000 Sq. ft., equipped with globally state-of-art GaAs techniques, and the first 6-inch VCSEL chip fab & packaging line in mainland China.*

*In recent years, Brightlaser has caught up extremely quickly with all the opportunities the market has been giving, is becoming increasingly competitive. Currently, we are working with world-wide-leading partners and customers in technologies, marketing, and sales.*

*To cope with the rapidly growing, we are seeking professional dealers, distributors to join this promising field. As a self-driven, proactive, taking initiative, team player, you are welcome to our fast-paced, dynamic team of collaborators.*