

# Changing Conventional Thinking About Lasers

## Abstract

JDSU is changing conventional thinking about lasers and laser companies by leveraging relevant core strengths from its other optics businesses to achieve exceptional results for its OEM laser customers. In particular, JDSU is applying its expertise from more than 20 years of high-volume production—and the stringent performance requirements demanded within the telecommunications industry—to produce commercial lasers with unmatched reliability, lifetime, and value.

This paper illustrates how JDSU is uniquely positioned to introduce a new paradigm to the laser industry. Leveraging its worldwide resources in manufacturing, research and development, customer support and supply chain processes to focus on original equipment manufacturers (OEMs).

## Introduction

JDSU focuses on delivering products tailored to the exacting needs of OEM laser customers by using its broad portfolio of photonic solutions to apply core technologies and capabilities unavailable to traditional laser manufacturers. These core strengths include the following:

- components, such as diode lasers
- design, especially fiber handling and product packaging
- optical coating, including both design and manufacture
- materials expertise and a world-class Materials Characterization Laboratory
- scalable manufacturing that provides quick ramp-up to volume production
- manufacturing experience based on stringent performance and reliability standards (not previously associated with the laser industry) pulled directly from JDSU's industry-leading telecommunications business.

For more than 20 years, JDSU has provided laser components and subsystems for a broad range of applications including semiconductor, biotechnology, materials processing, graphics and imaging, remote sensing and instrumentation. JDSU's offering includes gas, solid-state, diode and fiber product lines. By applying the benefits of its tried-and-true telecom practices and other optics businesses to commercial laser design and production, JDSU delivers improved reliability, repeatability and ease of integration for OEM customers.

## Industry convention

Most manufacturers today produce low-volume, highly customized designs, which are time-consuming to build and expensive to maintain. Many companies have successfully found their niche in the academic, scientific, and small-market industry, and although the potential to serve such specialized applications is attractive, the small batch processing approach precludes the ability to gain real, statistical control over manufacturing processes. This deficiency ultimately leads to time and expense incurred through interfacing with a traditional laser manufacturer's production model and adds risk to the project and product plans of large businesses and OEMs that require reliable, long-term laser solutions.

### **A new way of thinking about lasers**

Previously, many applications relied on gas-discharge lasers, such as argon-ion lasers, which are characterized by limited lifetimes, bulky packaging, poor electrical efficiency, and large heat-load considerations. Although instruments using gas lasers are still viable, market expectations for lasers have changed, driving the demand for lasers toward more efficient solid-state designs that enable lower cost of ownership, and increasingly smaller laser footprints within new instrument design.

The demand for cost-effective, high-volume, reliable continuous-wave lasers is leading toward a new way of thinking about lasers—unconstrained by traditional methods. Biotechnology instruments that use laser-induced fluorescence and light-scattering techniques are a natural match for this approach. Other market segments that benefit include graphics and imaging, micromachining, and semiconductor front-end instrument applications.

### **JDSU's unconventional approach**

JDSU has a rich portfolio of technologies and solutions unmatched by traditional laser manufacturers. In addition to its laser business, JDSU can access innovation from its industry-leading engineering in telecommunications, optical coatings, materials processing, and other photonic solutions. It can also draw packaging and design techniques, manufacturing experience and processes, qualified vendors and established supply chains from across its related businesses for the benefit of its laser customers.

### **Marketing with a difference**

JDSU has chosen to concentrate its efforts on long-term partnerships with OEM customers. As a result, JDSU has optimized performance of its lasers to meet specific OEM needs for reliability and volume manufacturability. In contrast to traditional laser manufacturers, whose customized designs yield lasers which are complex, bulky, and difficult to scale, JDSU lasers are designed for ease of integration, consistent reproduction, and cost savings. JDSU is committed to continually improving manufacturing standards and best practices—which means OEMs can depend on JDSU to deliver robust, next-generation lasers.

### **Value-added Manufacturing**

The telecommunications industry demands reliability in lasers and photonic components unheard of within the commercial lasers market space. Networked components deployed in remote and harsh environments, such as undersea networks, require high reliability throughout the entire product lifecycle. JDSU can apply assembly and packaging techniques, and the volume-manufacturing statistical control principles required to meet the demands of the telecommunications industry to OEM commercial laser production.

JDSU uses time-tested procedures and processes to produce lasers with long lifetimes, reliable performance, and lower price points—all manufactured to ISO 9001:2000 requirements. JDSU's manufacturing execution system tracks work in progress, providing detailed records on the production floor to ensure maximum quality and consistency. Computers at each workstation display updated assembly instructions and documentation, eliminating the need for paper-based data tracking. Data collected at the workstation can later be called up during performance review or forwarded to customers. During the build phase, each laser is thoroughly tested.

All of this takes place in Class 10,000 clean rooms and Class 100 environments, which require adherence to more stringent requirements than traditional optical manufacturing methods. Such strict standards for controlling contamination reduces potential failure modes, resulting in lasers with improved performance and reliability.

### Leveraging corporate capabilities

Sharing technology and manufacturing resources from across the entire company benefits JDSU's laser customers. A good illustration of this is JDSU's Materials Characterization Laboratory (MCL). The MCL is a unique, state-of-the-art center of excellence that provides consulting services, including failure analysis, materials characterization, and problem resolution to JDSU's engineering organizations. Through collaboration with its research and development teams, the MCL supports emerging technologies, allowing for enhanced efficiency in product development, and smooth transitions to manufacturing. Additionally, MCL scientists and engineers have been involved in the development, production, and ongoing support of many JDSU products, bolstering JDSU's continual improvement efforts.

JDSU also leverages its own existing telecom facilities, as well as those of its partners in Singapore and Shenzhen, China to support laser production. This allows, for example, the use of technology and manufacturing already established for telecom lithium modulators to be used for waveguides for lasers. Additionally, JDSU telecommunications design and manufacturing expertise was used to produce the most reliable diode lasers available for OEM commercial laser products.

In addition, JDSU uses its worldwide sales channels and distribution centers to support laser customers. Through its experience in serving large customers, JDSU has developed the agility and flexibility needed to meet changes in demand, providing peace of mind for OEMs. This year, industry-leader ESI recognized JDSU with its Supplier Responsiveness Award for 2007.

### Unconventional approach provides exceptional benefits: FCD488 case study

As instruments become smaller and more flexible, the market expects continued innovation. For instance, a minimized package size and heat load should enable higher package densities in the instrument, resulting in more lasers in smaller instruments. The maximized electrical efficiency from smaller power supplies will lead to smaller instruments. And a lighter delivery option, such as fiber, enables new instrument design concepts.

JDSU's unconventional approach to laser design and manufacturing has culminated in the FCD488; an efficient, compact, reliable 488nm CW laser. The FCD488 does not require external cooling fins or a bulky power supply. The FCD provides excellent beam quality, variable output power, and is capable of direct modulation. A complete FCD488 laser, with built-in control and power electronics, has a footprint of only 12.5 x 7 cm.

The FCD488 takes advantage of synergies that no other laser manufacturer can match, including:

- in-house optical coating design expertise
- telecom-grade, high-reliability laser diode components
- fiber handling technology employed directly from telco-grade factories
- packaging expertise from telecom (compact, high-volume manufacturability)
- economy of scale from shared manufacturing resources.

These synergies resulted in the elegant, fiber-based and highly manufacturable design of FCD 488 laser, which offers the following advantages:

- compact size—optics and electronics are integrated into one housing that is up to 70 percent smaller than current market offerings
- low heat load—no heat sink is required; the FCD488 produces savings of up to one-third the amount produced by comparable 488nm lasers

- superior efficiency—requires only a very small power supply with savings of up to one-third the amount of power by comparable lasers
- fiber-based architecture—enables fiber-delivery that allows for new instrument layouts, simple instrument manufacturability, and improved stability in field-installed instruments
- high reliability—telco-grade packaged components in a fiber-coupled butterfly package—a robust design that can withstand 18G vibration and 150G shock.



**FCD488: Best practices from JDSU laser and telecom teams lead to revolutionary size and efficiency.**

### Think again

Many participants in the laser market think of design and manufacturing in terms of conventional limitations to product reliability, repeatability and ease of integration. But there is another way.

JDSU's diverse capabilities address the major issues of concern—those of, reliability, superior performance and volume production. With the FCD488 platform, the most compact, efficient, and first truly fiber-delivered 488 nm laser, JDSU has delivered a next-generation laser that is revolutionizing the instrument market and changing conventional thinking about lasers.

Successful laser products require both continuous innovation and a plan for support over the entire lifecycle, which lasts for many years. By striving to develop relationships that will stand the test of time, JDSU takes a unique approach to marketing—building a longterm OEM partnership that will help customers succeed now and in the future.