High-Power Blue-Violet Laser Diode for Blu-ray Discs

SLD3233VF

The Blu-ray Disc Recorder can record digital high-definition television broadcasts with superb quality and with long recording times per disc.
A blue-violet laser diode is used as the light source.
Sony has now developed the SLD3233VF blue-violet laser diode that supports even higher densities and faster recording in Blu-ray Disc Recorders.
Compared to previous products, this laser diode increases the maximum optical power output by 55 mW and is capable of providing 120 mW in pulse drive mode. It also can operate under severe environment conditions up to a temperature of 75°C, and thus has the proven ability to function in IT applications.

- **Maximum optical power output: 120 mW (pulse drive mode)**
- **Low power and low noise**
- **High-temperature (75°C) operation guaranteed**

Maximum Optical Power Output: 120 mW (in pulse drive mode)

Sony has already released the SLD3232VF (pulse drive mode maximum optical power output: 65 mW) blue-violet laser diode as a light source for Blu-ray Disc drives. Even higher power levels, however, are now required in the blue-violet lasers that are used as the light source, to make higher recording densities and speeds possible in Blu-ray Disc Recorders. The newly-developed SLD3233VF minimizes reductions in reliability due to catastrophic optical damage (COD) by optimizing the laser structure and controlling the optical power density distribution in the optical region. As a result, Sony was able to create a blue-violet laser diode that is capable of a maximum optical power output of 120 mW in pulse drive mode.

Low Power and Low Noise

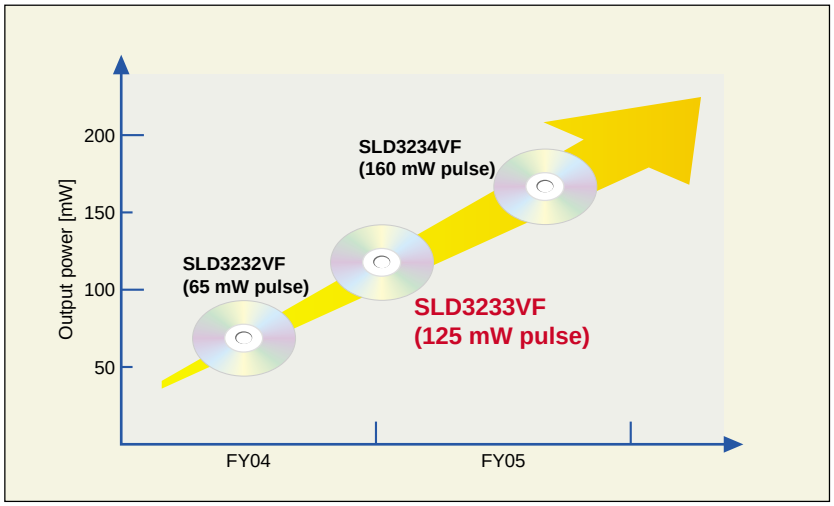
The blue-violet laser diode, whose base material is gallium nitride, is a device in which, due to the physical properties of the material itself, it is extremely difficult to acquire good current – voltage characteristics. Nonetheless, by adopting optimal electrode materials and structures, Sony was able to achieve laser operation at an operating voltage of 4.9 V (typical) (25°C, 65 mW CW drive mode). Sony also achieved, at the same time, both the low threshold current of 35 mA (typical) (25°C, CW drive mode) and the high differential efficiency of 1.5 mW/mA (typical) (25°C, CW drive mode) by optimizing the structure of the area around the emission point. As a result, it was also possible to achieve the low power of 0.39 W (typical) (25°C, 65 mW CW drive mode). Due to the reduction of the threshold current, it was also possible to reduce the natural optical emission component, which can cause fluctuations in the optical power output.

High-Temperature (75°C) Operation Guaranteed

During recoding by a Blu-ray Disc Recorder, the heat generated by both the structural components and the laser itself becomes significant. Also, since the internal areas of hardware used in IT applications can reach extremely high temperatures, high reliability in high-temperature environments is necessary in laser diodes. New structures were introduced in the optically active areas in the newly-developed SLD3233VF allowing this device to exhibit high resistance to temperature changes. The SLD3233VF's temperature characteristics are superlative, even when compared to red laser diode of conventional CD and DVD light sources, and this device can achieve stable operation even under severe environments with an environmental temperature of 75°C.

V O I C E

Blue-violet laser diodes are extremely difficult to design since they use new material families and processes. In addition, since this development project required doubling the optical power output over earlier products, there were many high hurdles that we had to deal with before we arrived at a product. Still, in the future, even higher recording speeds will be achieved in Blu-ray Disc systems. To respond to these market needs, our development staff will work together as an integrated team to develop devices with even higher output levels.

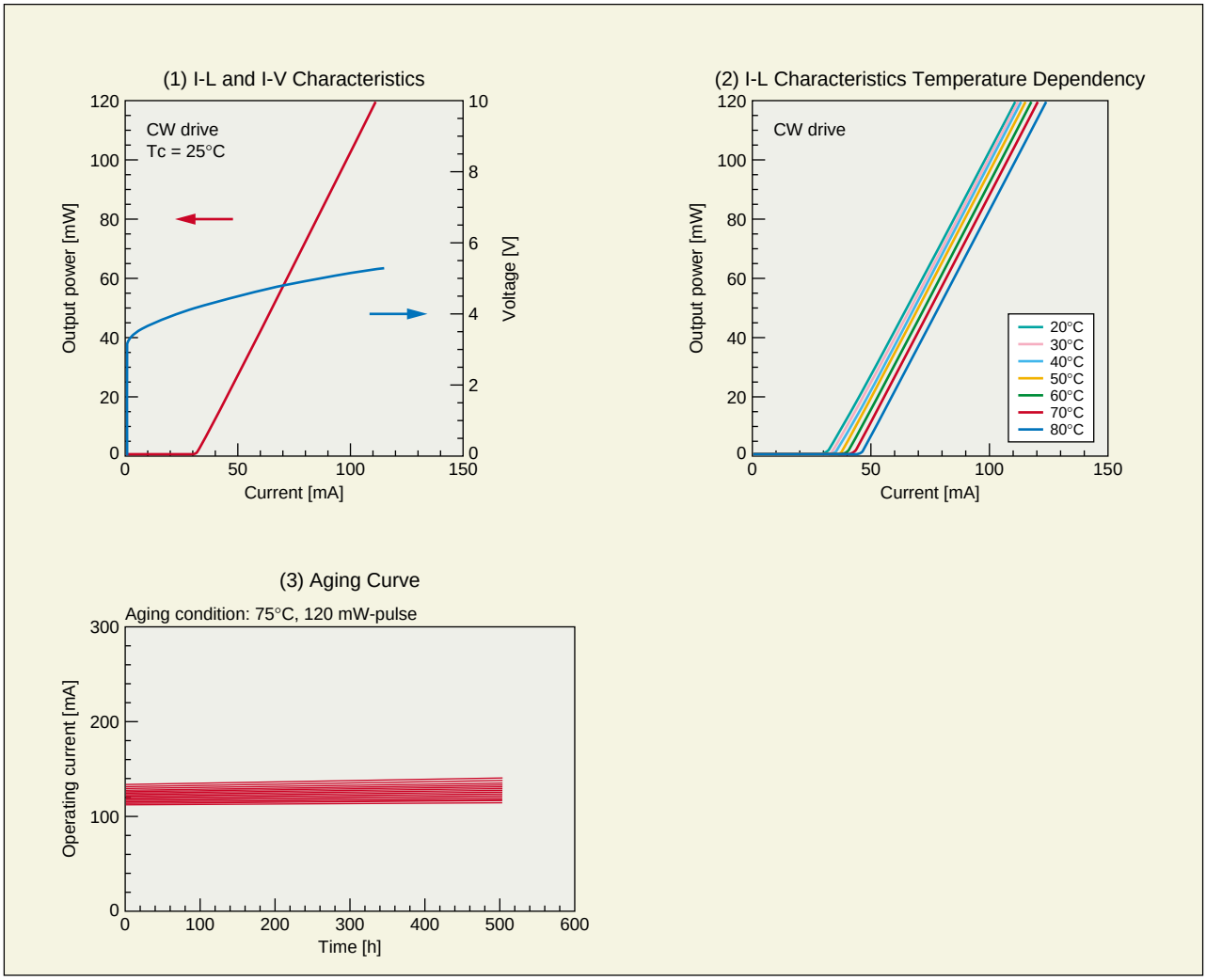


■ Figure 1 Blu-ray Disc Recording Laser Diode Development Trends

■ Table 1 Main Specifications

Item		Symbol	Typ.	Unit
Threshold current		Ith	35.0	mA
Operating current		Iop	80.0	
Operating voltage		Vop	4.9	V
Wavelength		λp	405.0	nm
Radiation angle	Parallel	θ//	8.5	deg.
	Perpendicular	θ⊥	21.0	
Differential efficiency		ηD	1.5	mW/mA

Condition: Tc = 25°C
Po = 65 mW @CW



■ Figure 2 Representative Characteristics