DVD Playback Laser Diode Requiring No High-Frequency Module

SLD1134VL

The DVD format stores seven times as much information as a CD-ROM. Sony is also the leader in the 650-nm band laser diode device area, a key device that supports the rapidly expanding DVD application area.
Now, to respond to demands for reduced noise in the next generation of DVD lasers, Sony has developed and is now adding to its product line the SLD1134VL low-noise self-excited oscillation laser diode that supports operation at temperatures up to 70°C for the first time in the industry.
This device is a DC drive-type laser diode that allows undesired radiation from the optical pickup to be ignored for all practical purposes.

- **Self-excited oscillation laser diode**
- **Maximum optical output: 5 mW**
- **Operating temperature: –10 to 70 °C**
- **RIN *1: Under –125 dB/Hz (At 4 mW, 5% return light, 70°C)**

*1 RIN: Relative intensity noise

Self-Excited Oscillation Laser Diode

The noise characteristics rating is one of the most important performance parameters in laser diodes. In particular, even lower noise levels than those in the 780-nm band CD lasers are required in the 650-nm band lasers used in DVD pickups. In optical disc systems, the light reflected from the disc surface returns to the pickup with irregular intensity. This is referred to as "return light," and the influence of this return light disrupts the laser operation, causing noise. In earlier systems, the superimposition of a high-frequency signal in the 300 MHz to 1 GHz range was used to reduce noise, but this technique has the following disadvantages:

- High power consumption in the high-frequency module, and
- Increased undesired radiation.
  In particular, handling problems due to undesired radiation is difficult in applications with small mounting areas, such as the DVD-ROM drives used in notebook personal computers.

Thus the best solution is to improve the noise characteristics of the laser so that high-frequency superimposition is not required, and it is the so-called "self-excited oscillation laser" structure that can achieve this. This laser has the property that its optical output turns on and off at a frequency between 300 MHz and 1 GHz even if it is driven from a DC source. However, the 650-nm laser materials used in DVD lasers have the unfortunate property that this self-excited oscillation stops at higher temperatures. This is because the energy involved increases as the wavelength becomes shorter, and it becomes more difficult to confine the electrons required for laser oscillation in the active layers. (See figure 1.) This is why a laser diode that achieves stable self-excited oscillation at the 70°C temperature required by DVD-ROM drives had never been achieved before.

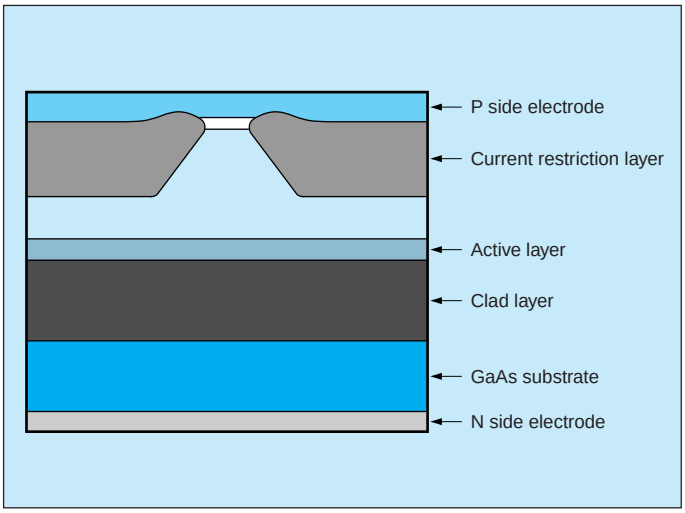
The Low-Noise SLD1134VL

The point that allowed this problem to be resolved was minimizing as much as possible the changes in device characteristics between room temperature and 70°C. We focussed on this point when designing the active layers of this DVD laser. The result was the SLD1134VL, a device that maintains laser oscillation at temperatures up to in excess of 100°C (figure 2) and low noise up to 70°C (figure 3). As you can see, this device provides stable operation for return light levels of up to 5%. This test value is measured at the worst case point, which was searched for by varying the phase of the light and the length of the optical path.

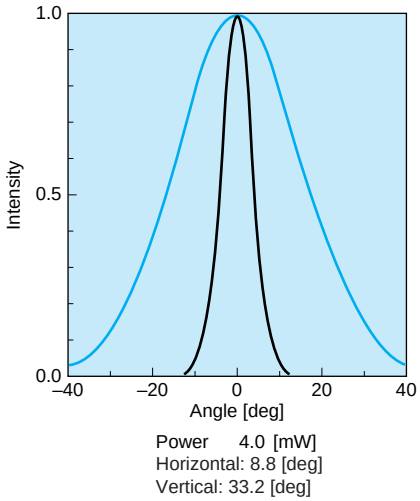
V O I C E

From the development planning stage we expected many difficulties on the way to the release of this device as a product. However, the development process went smoothly, and we were able to complete development ahead of schedule. The main point was that the level of the device technology used during the development of the first DVD laser, the Sony SLD1133VL, has been improved.

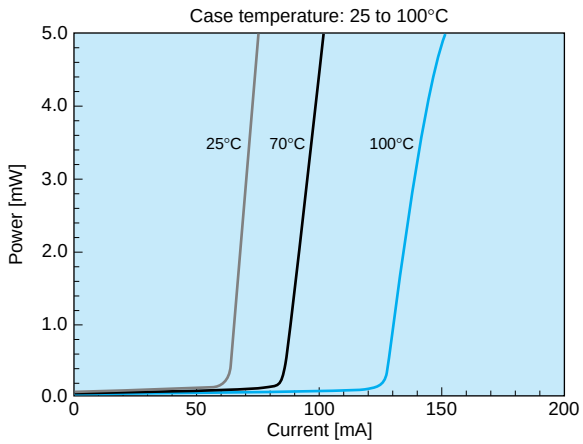
New Products



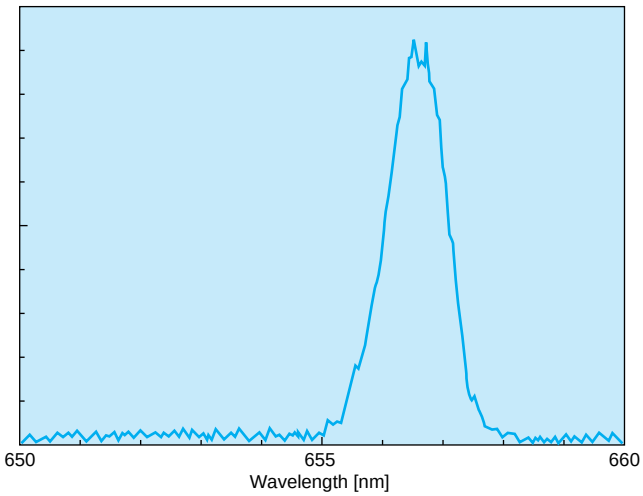
■ **Figure 1 SLD1134VL Chip Structure (AlGaInP family)**



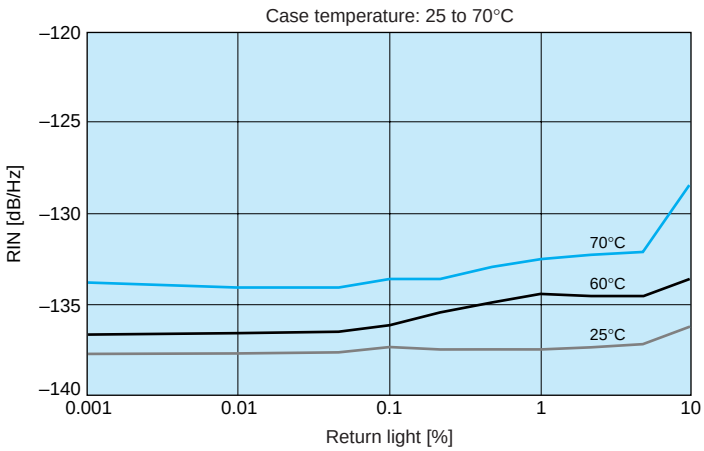
■ **Figure 4 Far-Field Pattern**



■ **Figure 2 I-L Characteristics**



■ **Figure 5 Spectrum**



■ **Figure 3 Relative Intensity Noise (RIN)**