PVG Series of Single-epitaxial-layer 1550 nm Pulsed Semiconductor Lasers

High Power Laser-Diode Family for Eye-Safe Range Finding

Available in several package types, the PVG series laser chips feature stripe widths of 150, 300 and 350 µm and can be stacked to further increase output power. Other stripe widths and packages options are available upon request.

Excellas Technologies’ PVG series of high power pulsed laser diodes are multi-quantum well devices with active layers fabricated using advanced MOCVD epitaxial growth techniques. The devices are offered housed in two convenient hermetic package configurations, either the “S” package, a TO-18 style low inductance package, or the “R” style, a CD 9 mm outline, providing increased thermal dissipation with the option of accommodating a rear facet monitor photodiode.

This series of devices are wavelength-centered at 1550nm primarily to take advantage of a significant increase over AlGaAs and InGaAs lasers in the maximum permitted emission level with respect to Laser Institute of America or International Electrotechnical Commission (IEC) requirements. It should be possible therefore to incorporate these diodes into a system and operate them at relatively high average powers within Class I conditions. It is however the responsibility of the user to certify their equipment as Class I and ensure that it meets the requirements of its appropriate local regulatory agency.

The output wavelength of this series is well matched to the near peak spectral response of Excellas InGaAs photodiodes types C30617H, C30618H, C30619H, C30645H and C30662H, amongst others.

Key Features
- Peak power to 100 Watts
- Good temperature stability
- Range of single element and stacked devices
- Possibility of high peak power Class I operation
- Package options available
- High reliability

Applications
- Eye-safe Laser Range Finder (LRF)
- Optical beacons
- Covert illumination
- Sensing
- Industrial metrology
- Laser safety curtains
- “Friend or Foe” identification

www.excelitas.com
**PVG Series of 1550 nm Pulsed Semiconductor Lasers**

**High Power Laser-Diode Family for Eye-safe Range Finding**

Table 1 – Characteristics at $T_{op} = 23\ ^\circ\ C$, $t_w = 150\ \text{ns}$, prr = 1 kHz

<table>
<thead>
<tr>
<th>Parameter</th>
<th>PVGS1S06H</th>
<th>PVGS2S06H</th>
<th>PVGR1S12H</th>
<th>PVGR1S14H</th>
<th>PVGR4S12H</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Optical Power at $i_F$ $P_{Omin}$</td>
<td>5</td>
<td>10</td>
<td>12</td>
<td>12</td>
<td>45</td>
<td>W</td>
</tr>
<tr>
<td>Typical Optical Power at $i_F$ $P_{Otyp}$</td>
<td>7</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>58</td>
<td>W</td>
</tr>
<tr>
<td>Peak forward Current $i_F$</td>
<td>20</td>
<td>20</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>A</td>
</tr>
<tr>
<td>Typical Optical Power at $i_{FM}$ $P_{Otyp.M}$</td>
<td>13</td>
<td>24</td>
<td>24</td>
<td>27</td>
<td>100</td>
<td>W</td>
</tr>
<tr>
<td>Maximum Peak forward Current $i_{FM}$</td>
<td>40</td>
<td>40</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>A</td>
</tr>
<tr>
<td>Lasing threshold current, typical $i_{TH}$</td>
<td>0.8</td>
<td>0.8</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>A</td>
</tr>
<tr>
<td>Typical Forward Voltage at $i_{FM}$ $V_F$</td>
<td>5.5</td>
<td>8.3</td>
<td>8.6</td>
<td>8.7</td>
<td>15</td>
<td>V</td>
</tr>
<tr>
<td>Number of Elements</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Emitting area (width x height)</td>
<td>150 x 1.5</td>
<td>150 x 125</td>
<td>300 x 1.5</td>
<td>350 x 1.5</td>
<td>300 x 350</td>
<td>µm</td>
</tr>
</tbody>
</table>

**Notes:**
1. Operating drive condition under reduced duty factor.
2. Excluding the voltage drop contribution due to the inductive element of the package, as estimated by $V_F = R_S i_F + V_g$.

Table 2 – Generic Electro-Optical Specifications at 23°C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min</th>
<th>Typical</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center wavelength of spectral envelope</td>
<td>$\lambda_c$</td>
<td>1520</td>
<td>1550</td>
<td>1580</td>
<td>nm</td>
</tr>
<tr>
<td>Spectral bandwidth at 50% intensity points</td>
<td>$\Delta \lambda$</td>
<td>13</td>
<td>13</td>
<td></td>
<td>nm</td>
</tr>
<tr>
<td>Wavelength temperature coefficient</td>
<td>$\Delta \lambda / \Delta T$</td>
<td>0.5</td>
<td>0.5</td>
<td></td>
<td>nm/°C</td>
</tr>
<tr>
<td>Beam spread (FWHM) parallel to junction plane</td>
<td>$\Theta_{</td>
<td></td>
<td>}$</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Beam spread (FWHM) perpendicular to junction plane</td>
<td>$\Theta_{\perp}$</td>
<td>38</td>
<td>38</td>
<td></td>
<td>degrees</td>
</tr>
</tbody>
</table>

Table 3 – Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak reverse voltage</td>
<td>$V_{RM}$</td>
<td>2</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Pulse width</td>
<td>$t_w$</td>
<td>150</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Duty factor</td>
<td>$du$</td>
<td>0.1</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_s$</td>
<td>-55</td>
<td>105</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>$T_{op}$</td>
<td>-55</td>
<td>85</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering for 5 seconds (leads only)</td>
<td></td>
<td></td>
<td>260</td>
<td>°C</td>
</tr>
</tbody>
</table>

www.excelitas.com
PVG Series of 1550 nm Pulsed Semiconductor Lasers

High Power Laser-Diode Family for Eye-safe Range Finding

Ordering Guide

<table>
<thead>
<tr>
<th>P</th>
<th>V</th>
<th>G</th>
<th>X</th>
<th>X</th>
<th>S</th>
<th>XX</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

S package
R package
Single chip stack
Dual chip stack
Quadruple chip stack
Stackable chip
0.006” wide laser stripe (150 μm)
0.012” wide laser stripe (300 μm)
0.014” wide laser stripe (350 μm)
RoHS compliance

Electro-Optical Characteristics

Figure 1 – Optical power vs. drive current for quad-element 300 μm stripe width at room temperature, reduced duty factor

Figure 2 – Optical power vs. drive current for single-stack 150 and 300 μm stripe
PVG Series of 1550 nm Pulsed Semiconductor Lasers
High Power Laser-Diode Family for Eye-safe Range Finding

Figure 3 – Typical peak wavelength spectrum

Figure 4 – Typical Center Wavelength as a Function of Temperature

Figure 5 – Radiant Intensity as a function of Half Angle

Figure 6 – Radiant Intensity as a function of F Number
PVG Series of 1550 nm Pulsed Semiconductor Lasers

High Power Laser-Diode Family for Eye-safe Range Finding

Figure 7 – Far Field Pattern Parallel to Junction Plane

Figure 8 – Far Field Pattern Perpendicular to Junction Plane

Package Drawings (Other packages available upon request)

Package S:
- Pin out
  1. LD Cathode (-)
  2. LD Anode (+), Case
- Inductance 5.2 nH

Package R:
- Pin out
  1. LD Cathode (-)
  2. NC
  3. LD Anode (+)
- Inductance 6.8 nH
For Your Safety

Laser Radiation:
Under operation, these devices produce invisible electromagnetic radiation that may be harmful to the human eye. To ensure that these laser components meet the requirements of Class IIIb laser products, they must not be operated outside their maximum ratings. Power supplies used with these components must be such that the maximum peak forward current cannot be exceeded. It is the responsibility of the user incorporating a laser into a system to certify the Class of use and ensure that it meets the requirements of the ANSI or appropriate authority.

Further details can be obtained in the following publications:

- 21CFR 1040.10 – “Performance Standards for Light Emitting Products (Laser Products)”
- IEC 60825-1 – “Safety of Laser Products”

Operating Conditions

The laser is operated by pulsing current in the forward bias direction.

The Excelitas warranty applies only to devices operated within the maximum rating, as specified. Exceeding these conditions is likely to cause permanent damage to the laser and consequently a significant reduction in optical power.

Operating the devices at increased duty cycles will ultimately and irreparably damage the crystal structure due to internal heating effects. Diodes are static-sensitive and suitable precautions should be taken when removing the units from their antistatic containers. Circuits should be designed to protect the diodes from high current and reverse voltage transients. Voltages exceeding the reverse breakdown of the semiconductor junction are particularly damaging and have been shown to cause degradation of power output. Although the devices will continue to perform well at elevated temperatures for some thousands of hours, defect mechanisms are accelerated.

Optimum long term reliability will be attained with the semiconductor at or below room temperature. Adequate heat sinking should be employed, particularly for the larger stacks and when operated at maximum duty factor.

Ordering Information

The “preferred package” options on the list will normally be offered at lower cost and with shorter delivery times. To keep the costs down the standard devices are tested and burned-in under standard conditions.

While the devices are warranted over the entire specification, for a quantity purchase, customers are advised to discuss their requirements in advance so that any special test needs can be accommodated and yields optimized.

Excelitas has been routinely supplying lasers for military applications since the early 1990s. These diodes benefit from long years of experience from screened laser diodes to European and North American military specifications. Though the commercial products are not continuously screened, they are designed to meet demanding environmental conditions.
Typical qualification of these parts would include:

- High Temperature Storage
- Hermetic Seal
- Thermal Shock
- Random Vibration
- Acceleration
- Mechanical Shock

Excelitas is pleased to assist with advice and test procedures for your specific environmental needs.
PVG Series of 1550 nm Pulsed Semiconductor Lasers

High Power Laser-Diode Family for Eye-safe Range Finding

RoHS Compliance

This series of laser diodes are designed and built to be fully compliant with the European Union Directive 2011/65/EU – Restriction of the use of certain Hazardous Substances (RoHS) in Electrical and Electronic equipment.

Warranty

A standard 12-month warranty following shipment applies. Any warranty is null and void if the package window has been opened.

About Excelitas Technologies

Excelitas Technologies is a global technology leader focused on delivering innovative, customized solutions to meet the lighting, detection and other high-performance technology needs of OEM customers.

Excelitas has a long and rich history of serving our OEM customer base with optoelectronic sensors and modules for more than 45 years beginning with PerkinElmer, EG&G, and RCA. The constant throughout has been our innovation and commitment to delivering the highest quality solutions to our customers worldwide.

From aerospace and defense to analytical instrumentation, clinical diagnostics, medical, industrial, and safety and security applications, Excelitas Technologies is committed to enabling our customers' success in their specialty end-markets. Excelitas Technologies has approximately 5,000 employees in North America, Europe and Asia, serving customers across the world.