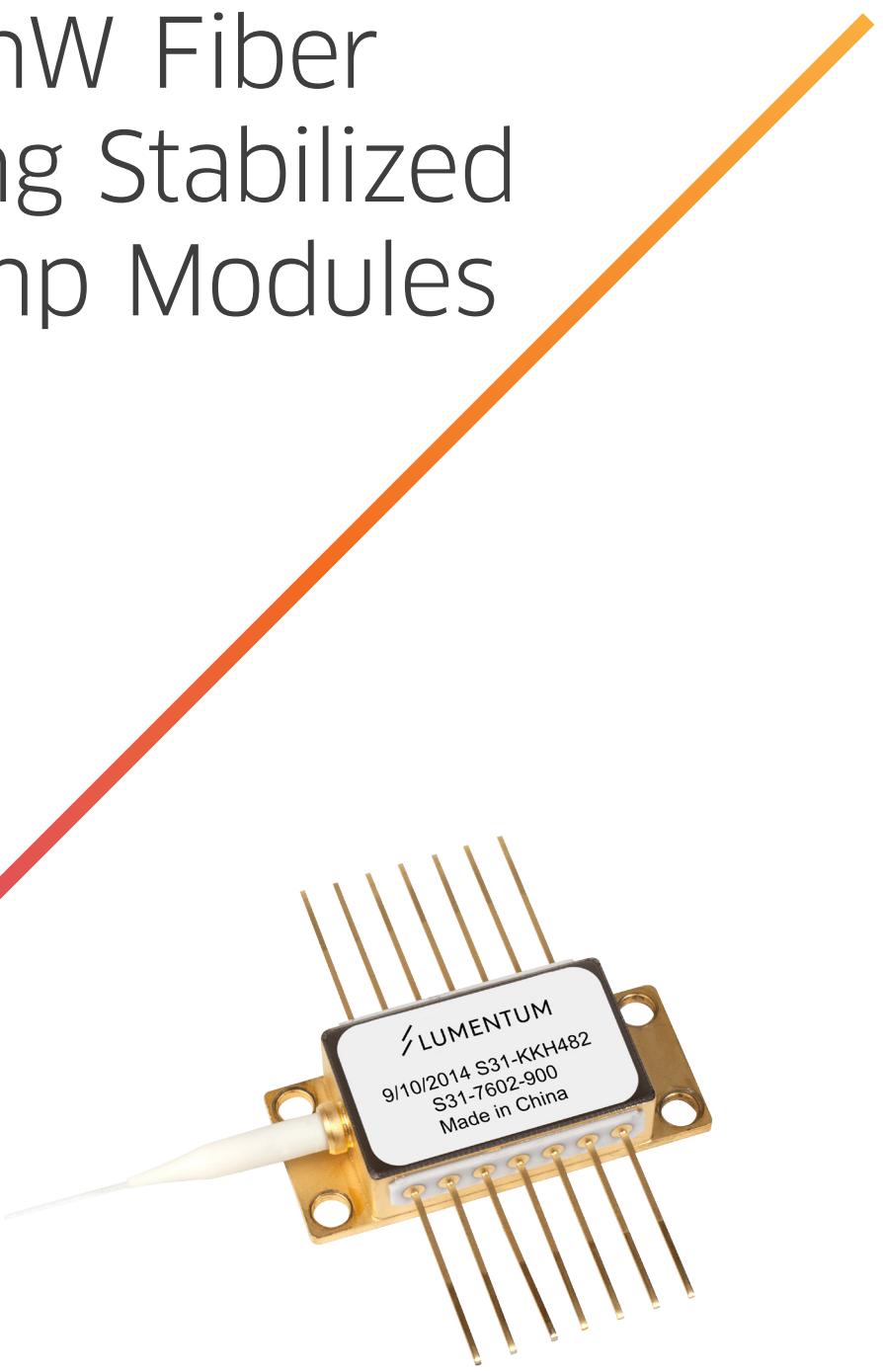


Up to 950 mW Fiber Bragg Grating Stabilized 980 nm Pump Modules

S31 Series



The Lumentum S31 Series pump laser module's revolutionary design and lean manufacturing processes significantly advance the 980 nm pumps' performance and scalability. It meets the telecommunications industry's stringent requirements, including Telcordia GR-468-CORE for hermetic 980 nm pump modules.

The S31 Series pump module, which uses fiber Bragg grating stabilization to lock the emission wavelength, provides a noise-free, narrowband spectrum, even under temperature, drive current, and optical feedback changes. Wavelength selection is available for applications requiring the highest spectrum control performance with the highest power available.

Key Features

- Operating power range from 600 to 950 mW
- 25°C internal temperature, compatible with legacy temperature control
- Low-profile 14-PIN butterfly package
- Fiber Bragg grating stabilization
- Wavelength selection available
- Integrated thermoelectric cooler, thermistor, and monitor diode
- High dynamic range
- Excellent low-power stability

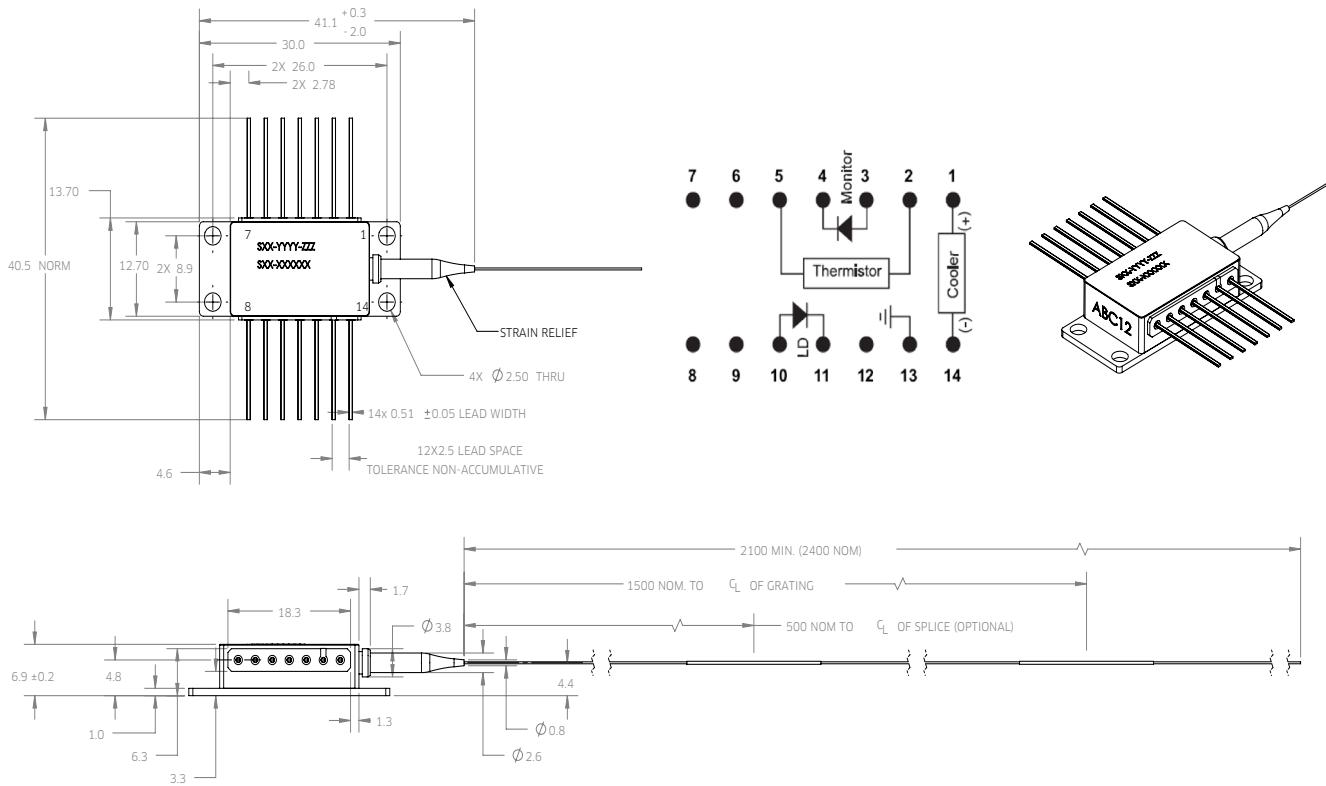
Applications

- Dense wavelength division multiplexing (DWDM) EDFA for small package designs
- High-bit-rate, high channel-count EDFA
- CATV distribution

Compliance

- Telcordia GR-468-CORE

Dimensions Diagram



Pin Assignments

| Pin | Description |
|-----|--------------------|
| 1 | Cooler (+) |
| 2 | Thermistor |
| 3 | Monitor PD anode |
| 4 | Monitor PD cathode |
| 5 | Thermistor |
| 6 | N/C |
| 7 | N/C |
| 8 | N/C |
| 9 | N/C |
| 10 | Laser anode |
| 11 | Laser cathode |
| 12 | N/C |
| 13 | Case ground |
| 14 | Cooler (-) |

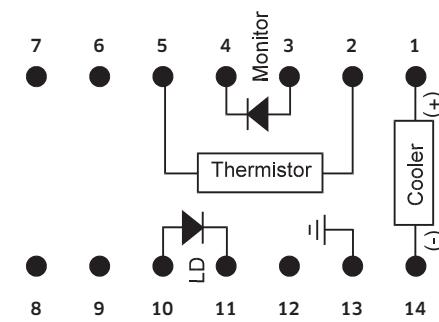


Table 1 Absolute Maximum Ratings

| Parameter | Symbol | Test Condition | Minimum | Maximum |
|----------------------------------|---------------|--------------------------------------|---------|------------|
| Operating case temperature | T_{op} | | -5°C | 75°C |
| Storage temperature | T_{stg} | 2000 hr | -40°C | 85°C |
| Laser operating temperature | T_{LD} | | -5°C | 50°C |
| LD reverse voltage | V_r | | - | 1.2 V |
| LD forward current | I_{f_max} | | - | 1900 mA |
| LD reverse current | | | - | 10 μ A |
| PD reverse voltage | V_{PD} | | - | 20 V |
| PD forward current | I_{PF} | | - | 10 mA |
| LD electrostatic discharge (ESD) | $V_{ESD\ LD}$ | $C = 100\ pF, R = 1.5\ k\Omega, HBM$ | | 1000 V |
| PD electrostatic discharge (ESD) | $V_{ESD\ PD}$ | $C = 100\ pF, R = 1.5\ k\Omega, HBM$ | | 500 V |
| TEC current | I_{TEC} | | -1.0 A | 4.0 A |
| TEC voltage | V_{TEC} | | - | 4.5 V |
| Axial pull force | | 3 x 10 s | - | 5 N |
| Side pull force | | 3 x 10 s | - | 2.5 N |
| Fiber bend radius | | | 16 mm | - |
| Relative humidity | RH | Noncondensing | 5% | 95% |
| Lead soldering time | | 300°C | - | 10 s |

Absolute maximum ratings are the maximum stresses that may be applied to the module for short periods of time without causing damage. Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Exposure to absolute maximum ratings for extended periods of time or exposure to more than one absolute maximum rating simultaneously may adversely affect device reliability. Specifications may not necessarily be met under these conditions.

Table 2 Operating Parameters¹

Fill in the xxxx with the suitable 4-digit wavelength code shown in Table 3.

| Product Code | Maximum Operating Power P_{op} (mW) | Maximum Operating Current I_{op} (mA) | Minimum Kink-Free Power P_{max} (mW) | Maximum Kink-Free Current I_{max} (mA) |
|--------------|---------------------------------------|---|--|--|
| S31-xxxx-600 | 600 | 1390 | 660 | 1500 |
| S31-xxxx-620 | 620 | 1410 | 680 | 1530 |
| S31-xxxx-640 | 640 | 1430 | 705 | 1555 |
| S31-xxxx-660 | 660 | 1450 | 725 | 1580 |
| S31-xxxx-680 | 680 | 1470 | 750 | 1605 |
| S31-xxxx-700 | 700 | 1490 | 770 | 1635 |
| S31-xxxx-720 | 720 | 1510 | 790 | 1660 |
| S31-xxxx-740 | 740 | 1530 | 815 | 1685 |
| S31-xxxx-760 | 760 | 1550 | 835 | 1710 |
| S31-xxxx-780 | 780 | 1570 | 860 | 1740 |
| S31-xxxx-800 | 800 | 1590 | 880 | 1765 |
| S31-xxxx-820 | 820 | 1610 | 900 | 1790 |
| S31-xxxx-840 | 840 | 1625 | 925 | 1815 |
| S31-xxxx-850 | 850 | 1645 | 935 | 1840 |
| S31-xxxx-860 | 860 | 1665 | 945 | 1870 |
| S31-xxxx-880 | 880 | 1675 | 970 | 1880 |
| S31-xxxx-900 | 900 | 1675 | 990 | 1880 |
| S31-xxxx-950 | 950 | 1675 | 1045 | 1880 |

1. BOL, $T_{case} = -5$ to 75°C , -50 dB reflection, unless noted otherwise

Table 3 Available Peak Wavelength Selection

Fill in the yyy with the maximum operating power shown in Table 2.

| Product Code | Minimum Center Wavelength | Maximum Center Wavelength |
|--------------|---------------------------|---------------------------|
| S31-7402-yyy | 973.0 nm | 975.0 nm |
| S31-7602-yyy | 975.0 nm | 977.0 nm |
| S31-8000-yyy | 973.0 nm | 981.5 nm |

Table 4 Electro-Optical Performance¹

| Parameter | Symbol | Test Condition | Minimum | Maximum |
|-----------------------------------|-----------------------|--|----------------|-----------------|
| Threshold current | I_{th-BOL} | | – | 110 mA |
| Forward voltage | V_f | $I_f = I_{op}$ | – | 2.6 V |
| Fiber output power range | P_f | | 30 mW | P_{op} |
| Pump power in band | P_{pump} | Pump band = $\lambda_m \pm 1.5$ nm, at P_{op} | 90% | |
| Spectral width | $\Delta\lambda_{RMS}$ | Over P_f range | | 2.0 nm |
| Wavelength tuning vs. temperature | $\Delta\lambda/T$ | $I_f = I_{op}$ | – | 0.01 nm/°C |
| Optical power stability | $\Delta P_{f,t}$ | Over P_f range, DC to 50 kHz, 30 mW – 50 mW | – | 5.0% |
| | | Over P_f range, DC to 50 kHz, 50 mW – P_{op} | – | 2.0% |
| Tracking ratio2 | TR | $0.1P_{op} < P_f < P_{op}$ | 0.52 | 1.48 |
| Tracking error3 | TE | P_{op} | -48% | 48% |
| Monitor diode responsivity | I_{BF} | At P_{op} | 0.5 μ A/mW | 5 μ A/mW |
| Thermistor resistance | R_{th} | $T_{set} = 25^\circ\text{C}$ | 9.5 k Ω | 10.5 k Ω |
| | | $T_{set} = 45^\circ\text{C}$ | 4.1 k Ω | 4.6 k Ω |

1. BOL, $T_{case} = -5^\circ\text{C}$ to 75°C , $P_f = 30$ mW to P_{max} , -50 dB reflection, MPD with -5 V bias, unless otherwise noted2. The tracking ratio is a measure of the front-to-back tracking when the output power is varied. On a plot of optical power versus back-face photocurrent, a straight line is drawn between the minimum power (30 mW) and the operating power (P_{op}) points. The tracking ratio is defined as the ratio between measured optical power (shown as data points on the plot) to the value derived from the straight line.3. The tracking error is defined as the normalized change of output power relative to P_f at 25°C , that is, $(P_f - P_{f,25})/P_{f,25}$, over case temperature range of 0 to 75°C , at constant back face monitor current corresponding to the lowest back face monitor current at $P_f = P_{op}$ of 0°C , 25°C , 75°C .

Table 5 TEC and Total Module Power Consumption¹

| Product Code | TEC Current I_{max} (A) | TEC Voltage V_{max} (V) | TEC Power Consumption P_{TEC} (W) | Total Module Power Consumption P_{max} (W) |
|--------------|---------------------------|---------------------------|-------------------------------------|--|
| S31-xxxx-600 | 2.28 | 2.87 | 6.54 | 9.69 |
| S31-xxxx-620 | 2.30 | 2.88 | 6.62 | 9.83 |
| S31-xxxx-640 | 2.31 | 2.90 | 6.70 | 9.98 |
| S31-xxxx-660 | 2.33 | 2.92 | 6.80 | 10.13 |
| S31-xxxx-680 | 2.35 | 2.94 | 6.89 | 10.28 |
| S31-xxxx-700 | 2.36 | 2.95 | 6.99 | 10.44 |
| S31-xxxx-720 | 2.38 | 2.97 | 7.08 | 10.59 |
| S31-xxxx-740 | 2.40 | 2.99 | 7.19 | 10.76 |
| S31-xxxx-760 | 2.42 | 3.01 | 7.27 | 10.91 |
| S31-xxxx-780 | 2.44 | 3.03 | 7.40 | 11.10 |
| S31-xxxx-800 | 2.46 | 3.05 | 7.53 | 11.30 |
| S31-xxxx-820 | 2.49 | 3.08 | 7.65 | 11.49 |
| S31-xxxx-840 | 2.50 | 3.09 | 7.74 | 11.63 |
| S31-xxxx-850 | 2.53 | 3.11 | 7.87 | 11.82 |
| S31-xxxx-860 | 2.55 | 3.14 | 8.00 | 12.01 |
| S31-xxxx-880 | 2.60 | 3.18 | 8.27 | 12.34 |
| S31-xxxx-900 | 2.65 | 3.23 | 8.56 | 12.67 |
| S31-xxxx-950 | 2.65 | 3.23 | 8.56 | 12.67 |

1. (BOL, $\Delta T = 30^\circ\text{C}$, $T_{case} = 75^\circ\text{C}$, $T_{LD} = 45^\circ\text{C}$)**Table 6 HI 1060 Fiber Nominal Characteristics and Tolerances**

| Parameters | Specification |
|-------------------------------|---------------------------|
| Cutoff wavelength | 920 nm |
| Maximum attenuation at 980 nm | 2.1 dB/km |
| Cladding outside diameter | $125 \pm 1 \mu\text{m}$ |
| Coating outside diameter | $245 \pm 10 \mu\text{m}$ |
| Core-cladding concentricity | $\leq 0.5 \mu\text{m}$ |
| Mode field diameter | $5.9 \pm 0.3 \mu\text{m}$ |

Note:

PM fiber option is available upon request.

User Safety

Safety and Operating Considerations

The laser light emitted from this laser diode is invisible and may be harmful to the human eye. Avoid looking directly into the fiber when the device is in operation.

CAUTION: THE USE OF OPTICAL INSTRUMENTS WITH THIS PRODUCT INCREASES EYE HAZARD.

Operating the laser diode outside of its maximum ratings may cause device failure or a safety hazard. Power supplies used with this component cannot exceed maximum peak optical power.

CW laser diodes may be damaged by excessive drive current or switching transients. When using power supplies, the laser diode should be connected with the main power on and the output voltage at zero. The current should be increased slowly while monitoring the laser diode output power and the drive current. Careful attention to heat sinking and proper mounting of this device is required to ensure specified performance over its operating life. To maximize thermal transfer to the heat sink, the heat sink mounting surface must be flat to within .001 inch and the mounting screws must be torqued down to 1.5 in.-lb.

ESD PROTECTION—Electrostatic discharge (ESD) is the primary cause of unexpected laser diode failure. Take extreme precaution to prevent ESD. Use wrist straps, grounded work surfaces, and rigorous antistatic techniques when handling laser diodes.

Labeling

Laser Safety

The Lumentum pump laser module emits hazardous invisible laser radiation.

Due to the small size of the pump module, the box packaging is labeled with the laser radiation hazard symbol and safety warning labels shown



14-pin module label



Shipping box label

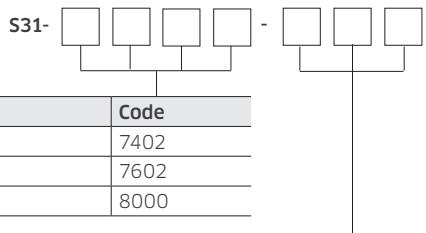


Output power and laser emission indicator label

Ordering Information

For more information on this or other products and their availability, please contact your local Lumentum account manager or Lumentum directly at customer.service@lumentum.com

Telcordia is a registered trademark of Telcordia Technologies Incorporated.



| Peak Wavelength | Code |
|-------------------|------|
| 973.0 to 975.0 nm | 7402 |
| 975.0 to 977.0 nm | 7602 |
| 973.0 to 981.5 nm | 8000 |

| Maximum Operating Power | Code |
|-------------------------|------|
| 600 mW | 600 |
| 620 mW | 620 |
| 640 mW | 640 |
| 660 mW | 660 |
| 680 mW | 680 |
| 700 mW | 700 |
| 720 mW | 720 |
| 740 mW | 740 |
| 760 mW | 760 |
| 780 mW | 780 |
| 800 mW | 800 |
| 820 mW | 820 |
| 840 mW | 840 |
| 860 mW | 860 |
| 880 mW | 880 |
| 900 mW | 900 |
| 950 mW | 950 |



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