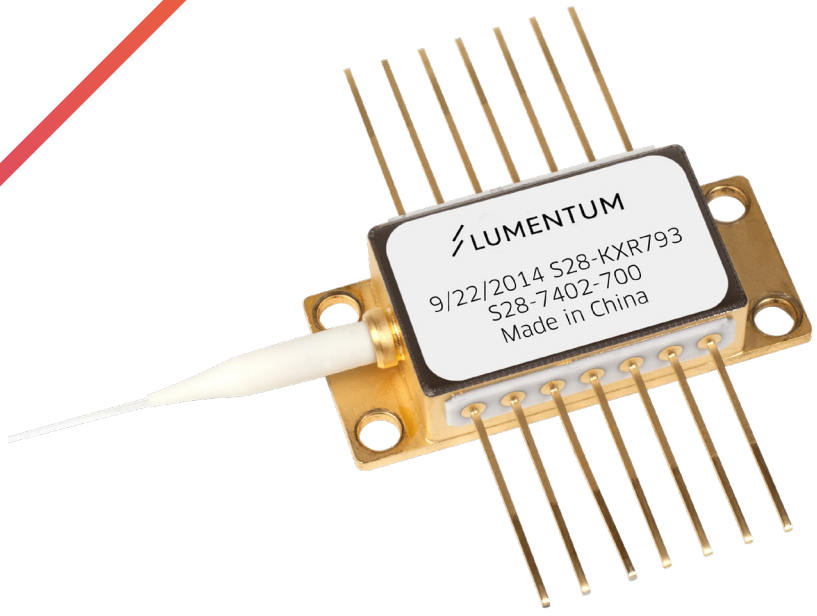
LUMENTUM

Up to 700 mW Fiber Bragg Grating Stabilized 980 nm Pump Modules with Low-Power Consumption

S28 Series



The Lumentum S28 Series 980 nm pump laser modules use a number of revolutionary design steps and the very latest material technologies to significantly improve production process scalability. The 'semicooled' 45°C laser diode operation significantly reduces TEC and overall power consumption. The module meets the stringent telecommunications industry requirements, including Telcordia GR-468-CORE for hermetic 980 nm pump modules.

The S28 Series pump module, which uses fiber Bragg grating stabilization to lock the emission wavelength, provides a noise-free, narrowband spectrum, even under changes in temperature, drive current, and optical feedback. Wavelength selection is available for applications requiring the highest spectrum control performance with the highest power available.

Key Features

- Operating power range from 300 to 700 mW
- Reduced TEC power consumption
- 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

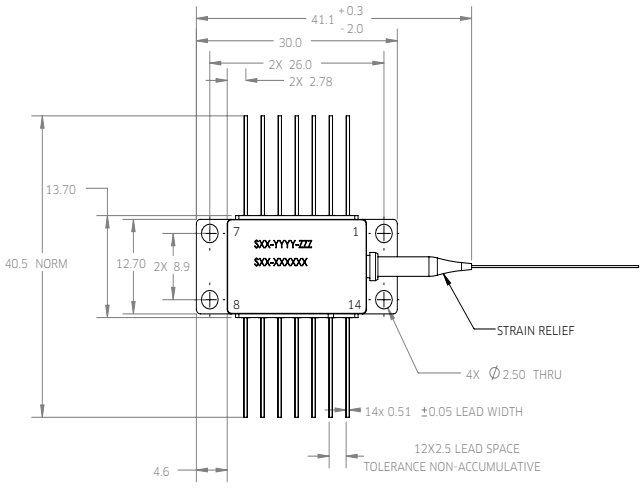
Applications

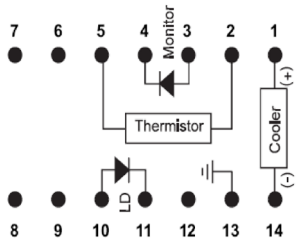
- Dense wavelength division multiplexing (DWDM) EDFAs for small package designs
- High-bit-rate, high-channel-count EDFAs
- CATV distribution

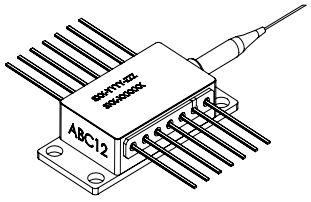
Compliance

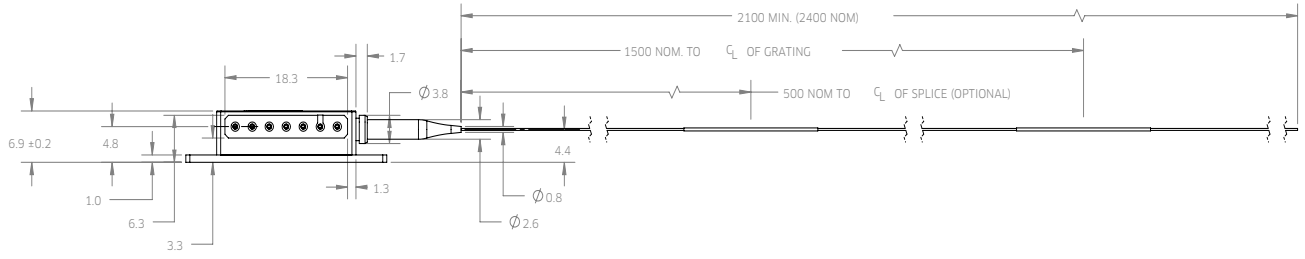
- Telcordia GR-468-CORE

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 (–)

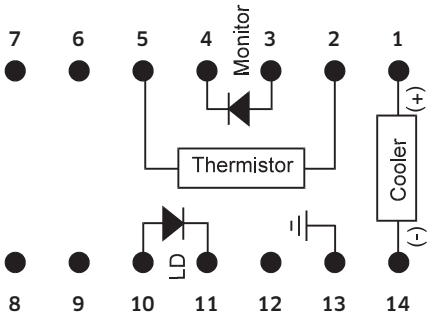


Table 1 Absolute Maximum Ratings

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}		–15°C	60°C
LD reverse voltage	V_r		–	1.2 V
LD forward current	I_{f_max}		–	1700 mA
LD reverse current			–	10 µA
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 kΩ, HBM		1000 V
PD electrostatic discharge (ESD)	$V_{ESD\,PD}$	C = 100 pF, R = 1.5 kΩ, HBM		500 V
TEC current	I_{TEC}		–1.25 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 Parameters[1]

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)
S28-xxxx-300	300	715	330	775
S28-xxxx-320	320	755	350	820
S28-xxxx-340	340	795	375	865
S28-xxxx-360	360	835	395	910
S28-xxxx-380	380	875	420	955
S28-xxxx-400	400	915	440	995
S28-xxxx-420	420	955	460	1040
S28-xxxx-440	440	995	485	1085
S28-xxxx-460	460	1035	505	1130
S28-xxxx-480	480	1075	530	1175
S28-xxxx-500	500	1120	550	1220
S28-xxxx-520	520	1160	570	1260
S28-xxxx-540	540	1200	595	1305
S28-xxxx-560	560	1240	615	1350
S28-xxxx-580	580	1280	640	1395
S28-xxxx-600	600	1320	660	1445
S28-xxxx-620	620	1360	680	1490
S28-xxxx-640	640	1400	705	1535
S28-xxxx-660	660	1445	725	1575
S28-xxxx-680	680	1485	750	1620
S28-xxxx-700	700	1525	770	1675

1. BOL, Tcase = -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
S28-7402-yyy	973.0 nm	975.0 nm
S28-7602-yyy	975.0 nm	977.0 nm
S28-8000-yyy	973.0 nm	981.5 nm

Table 4 Electro-Optical Performance[1]

Parameter	Symbol	Test Condition	Minimum	Maximum
Threshold current	$I_{th\text{-}BOL}$		–	125 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 = λ_m ±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	ΔP_{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 ratio[2]	TR	$0.1P_{op} < P_f < P_{op}$	0.52	1.48
Tracking error[3]	TE	P_{op}	–48%	48%
Monitor diode responsivity	I_{BF}	At P_{op}	0.5 µA/mW	5 µA/mW
LD temperature	T_{LD}	Nominal T_{LD} = 45°C	44°C	46°C
Thermistor resistance	R_{th}	T_{set} = 25°C	9.5 kΩ	10.5 kΩ
		T_{set} = 45°C	4.1 kΩ	4.6 kΩ

1. BOL, T_{case} = –5°C to 75°C, T_{LD} = 45°C, P_f = 30 mW to P_{max}, –50 dB reflection, MPD with –5 V bias, unless otherwise noted
2. 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. 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 Consumption[1]

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)
S28-xxxx-300	0.98	1.38	1.36	2.73
S28-xxxx-320	1.00	1.39	1.39	2.86
S28-xxxx-340	1.01	1.41	1.42	2.99
S28-xxxx-360	1.03	1.42	1.46	3.12
S28-xxxx-380	1.04	1.44	1.50	3.27
S28-xxxx-400	1.06	1.45	1.54	3.41
S28-xxxx-420	1.08	1.47	1.59	3.57
S28-xxxx-440	1.10	1.49	1.64	3.72
S28-xxxx-460	1.12	1.51	1.70	3.89
S28-xxxx-480	1.14	1.53	1.75	4.06
S28-xxxx-500	1.17	1.56	1.82	4.25
S28-xxxx-520	1.19	1.58	1.88	4.43
S28-xxxx-540	1.22	1.61	1.95	4.62
S28-xxxx-560	1.24	1.63	2.02	4.81
S28-xxxx-580	1.27	1.66	2.10	5.01
S28-xxxx-600	1.30	1.69	2.19	5.22
S28-xxxx-620	1.33	1.71	2.27	5.43
S28-xxxx-640	1.36	1.74	2.36	5.65
S28-xxxx-660	1.39	1.77	2.46	5.89
S28-xxxx-680	1.42	1.81	2.56	6.12
S28-xxxx-700	1.45	1.84	2.67	6.36

1. (BOL, ΔT = 30°C, T_{case} = 75°C, T_{LD} = 45°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 ±1 μm
Coating outside diameter	245 ±10 μm
Core-cladding concentricity	≤0.5 μm
Mode field diameter	5.9 ±0.3 μm

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

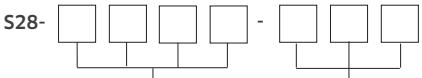
14-pin module label

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



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
300 mW	300
320 mW	320
340 mW	340
360 mW	360
380 mW	380
400 mW	400
420 mW	420
430 mW	430
450 mW	450
500 mW	500
550 mW	550
600 mW	600
620 mW	620
640 mW	640
660 mW	660
680 mW	680
700 mW	700

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