



## High Power 980nm Pump Laser Module for Submarine Applications

### Features:

- 400mW output power
- Ultra high reliability of <25 FIT at 90% CL
- Epoxy free, flux free 14-pin low profile butterfly package
- Polarization maintaining fiber (PMF) pigtail
- Fiber Bragg Grating (FBG) stabilized
- Internal monitoring photodiode
- Full performance from 0 to 43°C
- Low power consumption
- Telcordia GR-468-CORE qualified
- RoHS compliant

### Applications:

- Low noise DWDM Erbium Doped Fiber Amplifiers servicing Ultra Long Haul submarine links
- Military and space applications requiring ultra high reliability
- Uncooled multi pumping architectures

### Description

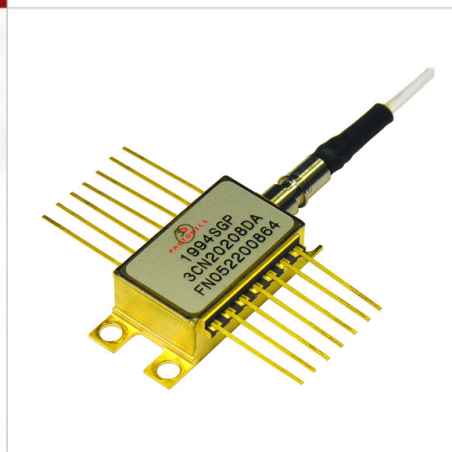
The 1994 SGP modules contain a new high power laser chip and an improved legacy package developed by 3S PHOTONICS and based on our field deployed legacy design. It is rated at 400mW operating power, the highest available in the industry today.

The wavelength is "locked" utilizing a fiber Bragg grating (FBG) and polarization maintaining fiber (PMF), providing excellent stability and very wide dynamic range. These modules also contain a back-facet photodiode for monitoring purposes and a getter.

This pump is especially targeted for use in Erbium Doped Fiber Amplifiers (EDFAs) in submerged repeaters and active branching units.

Stringent burn-in and aging processes for the laser chip and module are utilized to guarantee ultra high reliability required by submarine systems, and "Pedigree Reviews" are provided to our customers as necessary.

3S PHOTONICS' high power submarine pumps now enable new repeater designs with reduced pump count, low power consumption, and overall reduced amplifier footprint.





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### Electro-Optical Characteristics

The following parameters are specified BOL for  $V_{\text{BFM}} = -5\text{V}$ , -50dB max back-reflection and  $T_{\text{case}} = 0^\circ\text{C}$  to  $43^\circ\text{C}$  unless otherwise stated.

Parameters	Conditions	Symbol	Min	Typ	Max	Unit
<b>PUMP LASER</b>						
Threshold current	Note 1	$I_{\text{th}}$			100	mA
Nominal operating power		$P_{\text{nom}}$		400		mW
Kink free power	Note 2	$P_{\text{kink}}$	$1.1 \times P_{\text{nom}}$	-	-	mW
Forward current @ $P_{\text{nom}}$	Note 3	$I_{\text{nom}}$		800		mA
Forward voltage	@ 400mW	$V_{\text{nom}}$	-		2.4	V
Peak wavelength (vacuum)	@ $T_{\text{case}} = T_{\text{FBG}} = 25^\circ\text{C}$	$\lambda_{\text{p}}$	972	-	982	nm
Peak wavelength tolerance	@ $T_{\text{case}} = T_{\text{FBG}} = 25^\circ\text{C}$ 50mW to $P_{\text{nom}}$	$\Delta\lambda_{\text{p}}$	-	-	$\pm 1$	nm
Wavelength change vs temperature ( $T_{\text{grating}} = 0$ to $43^\circ\text{C}$ )	50mW to $P_{\text{nom}}$	$\Delta\lambda_{\text{p}} / \Delta T$	-	0.01	0.02	nm/ $^\circ\text{C}$
Spectral width @ -3dB	50mW to $P_{\text{nom}}$	$\Delta\lambda_{\text{FWHM}}$	-	-	1	nm
Power in band	Note 4	$P_{\text{inband}}$	80	-	-	%
Power consumption	@ 400mW	$P_{\text{t}}$	-	1.5	-	W
<b>MONITOR DIODE</b>						
Responsivity		$dI_{\text{BFM}} / dP$	0.5	-	25	$\mu\text{A}/\text{mW}$
Dark current	$V_{\text{r}} = 5\text{V}$	$I_{\text{BFM\_dark}}$	-	-	25	nA

Note 1:  $I_{\text{th}}$  is the intersection point with the x-axis of a linear fit of the P(I) curve between 15 and 50mW

Note 2: A kink is detected when the local slope,  $dP/dI$ , is below  $S_{\text{min}}$  or above  $S_{\text{max}}$ .

$S_{\text{min}}$  is defined as  $0.5 \times S_{\text{avg}}$  and  $S_{\text{max}}$  is defined as  $1.5 \times S_{\text{avg}}$

$S_{\text{avg}}$  is the slope of a linear fit of the P(I) curve between 50 and 150mW.

Note 3: EOL forward current is defined as  $I(\text{EOL}) = 1.1 \times I(\text{BOL})$

Note 4: Power in band is defined as the ratio between the power contained within a band of  $\pm 2\text{nm}$  around peak wavelength and the power contained within a band of  $\pm 25\text{nm}$  around peak wavelength





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### Absolute Maximum Ratings

Exposing this device to stresses and conditions above those listed in this section could cause permanent damage and affect reliability. The device is not meant to operate outside the operational limits described in previous sections at any length of time.

Parameter Conditions	Symbol	Min	Max	Unit
Storage temperature (2000 hrs)	$T_{stg}$	-40	85	°C
Operating temperature	$T_{op}$	0	43	°C
Lead soldering temperature (10 sec maximum)		-	260	°C
LD forward drive current	$I_{f\_max}$	-	950	mA
LD reverse voltage	$V_{r\_max}$	-	2	V
PD reverse voltage	$V_{PD\_max}$	-	10	V
PD forward current	$I_{PD\_max}$	-	2	mA
ESD* applied on PIN detector (Pin 3 & 4)	$V_{ESD}$	-	300	V
ESD* applied on other Pins	$V_{ESD}$	-	1000	V
Mounting torque		-	150	mN.m
Fiber bend radius		20	-	mm
Axial pull force (10s maximum)		-	7	N

\* Human Body Model, C= 100pF, R= 1.5Ω

### PM Fiber Pigtail Characteristics

Parameters	Note	Min	Typ	Max	Unit
Fiber type		SM98-PS-U25A-H			
Coating diameter	(except along grating)	230	250	270	μm
FBG recoat diameter		-	-	400	μm
Loose tube buffer diameter		885	-	915	μm
Fiber proof test level		200			kpsi
Grating proof test level	2 seconds	13			N
Pigtail length			6		m
Grating position vs module end face			4		m
Pigtail termination	with or without APC ferrule				

Laser chip power is coupled into slow axis of the fiber.

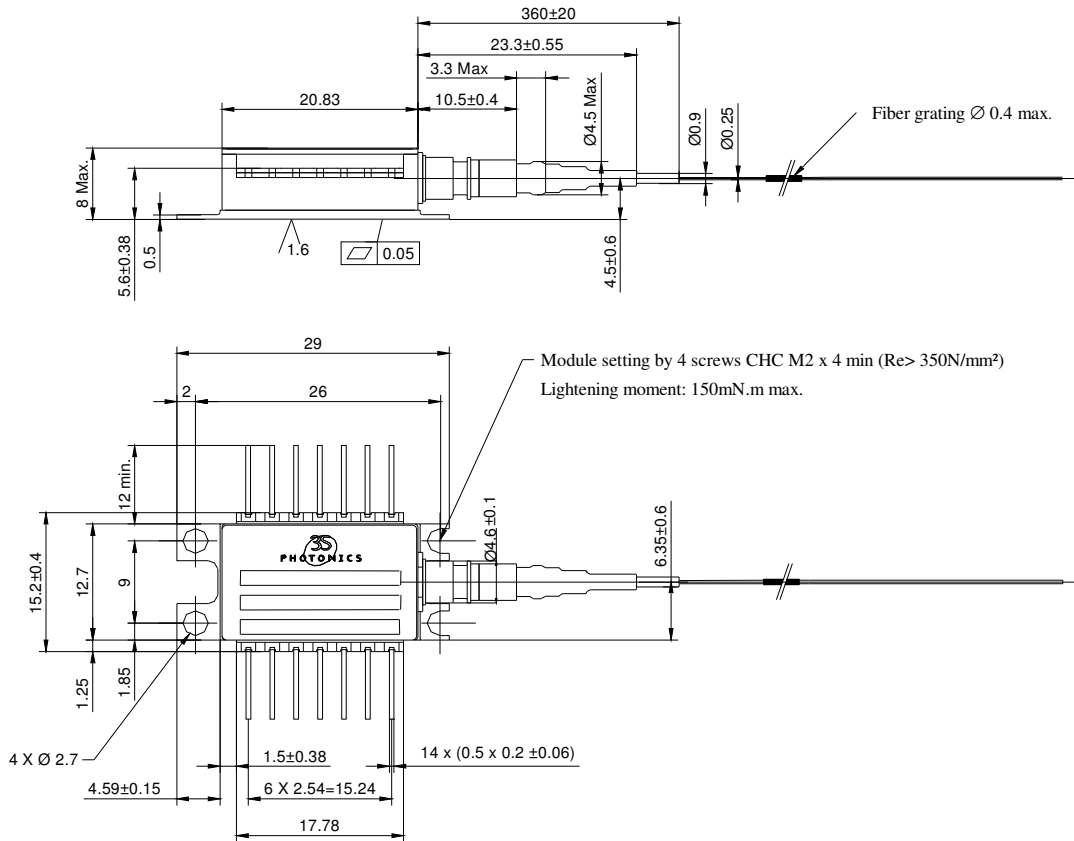




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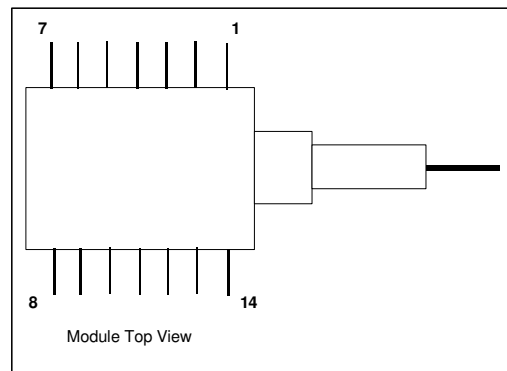
## Mechanical Details

Dimensions are in mm.



## PIN Assignment

Pin #	Description
1	No connect
2	No connect
3	Monitor PD Anode
4	Monitor PD Cathode
5	No connect
6	No connect
7	No connect
8	No connect
9	No connect
10	Laser Anode (+)
11	Laser Cathode (-)
12	No connect
13	Ground
14	No connect



Totally floating pin-out.



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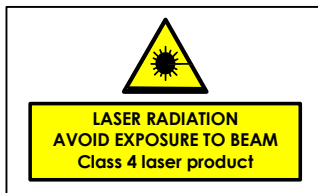
### Laser Safety Information

This laser module emits invisible light. Take appropriate precautions to prevent undue exposure to naked eye when module is in operation. This product is classified Class 4 Laser Product according to IEC-825-1.

### Handling

This product is sensitive to electrostatic discharge and should not be handled except at a static free workstation. Take precautions to prevent ESD ; use wrist straps, grounded work surfaces and recognized anti-static techniques when handling the SGP pump laser modules. Handle the module by its package only, never hold it by its pigtail.

Care should be taken to avoid supply transient currents and voltages. Drive voltage above the maximum specified in absolute maximum rating section may cause permanent damage to the device.



### Ordering Information

1994 SGP product family:

Nominal Power (mW)	Part Number
200	On request
250	On request
300	On request
350	On request
400	On request

Standard wavelengths : 974nm & 976nm - other wavelengths available upon request

Customized versions are available for volume quantities.

Performance figures contained in this document must be specifically confirmed in writing by 3S PHOTONICS before they become applicable to any order or contract. 3S PHOTONICS reserves the right to make changes to the products or information contained herein without notice.

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