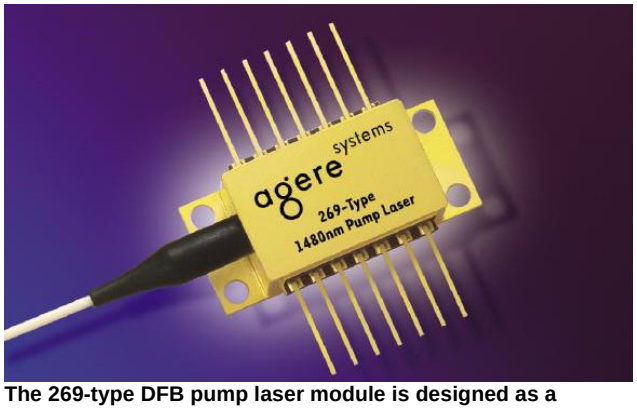
269-Type 14xx nm DFB Pump Laser Module



The 269-type DFB pump laser module is designed as a continuous-wave (CW) optical pump source for erbium-doped fiber amplifiers.

Features

- Low relative intensity noise (RIN)
- High-coupled rated output power up to 280 mW, CW
- Wide environmental range
- Field-proven packaging technology
- InGaAsP/InP high-power, strained multiple quantum-well (MQW), distributed-feedback (DFB) laser chip design
- Internal optical isolator (optional)
- Internal thermoelectric cooler (TEC)
- InGaAs PIN photodetector back-facet monitor
- Single-mode and polarization-maintaining fiber pigtails
- Compact, 14-pin butterfly package
- Industry compatible package and pinout

Applications

- Raman pump modules (RPM), copropagating and counterpropagating
- Erbium-doped fiber amplifiers (EDFA)

Description

The 269-type DFB pump laser module represents a family of thermoelectrically cooled, high-power lasers. These devices achieve stable wavelength performance within the 1420 nm to 1510 nm range, over the full operating temperature range. They are designed as continuous-wave (CW) optical pump sources for dense wavelength-division multiplexing (DWDM) EDFA and Raman applications operating in the C- and L-bands.

These new high-power DFB products represent a breakthrough in 14xx nm pump laser technology by integrating the beneficial characteristics of an external FBG laser design (such as stimulated Brillouin scattering suppression) with the superior relative-intensity noise (RIN) performance of a DFB laser. The combination of both characteristics is critical to enable copropagating Raman pumping, which distributes gain over the first few kilometers of the transmission fiber. The typical RIN value Agere Systems' DFB lasers is –158 dB/Hz, a major improvement over comparable external FBG-stabilized lasers with a typical RIN of –125 dB/Hz. Integrating wavelength stabilization into the chip improves the stabilization over operating temperature and thereby eliminates the need for an external FBG .

The laser modules incorporate a high-power, quantum-well laser chip that achieves fiber powers up to 280 mW.

An integral thermoelectric cooler (TEC) stabilizes the laser at room temperature and, combined with a hermetic environment, allows the device to achieve high-power operation over the extended temperature range of 0 °C to 75 °C. An internal InGaAs PIN photodiode, mounted behind the laser diode, functions as the laser detector and monitors light emissions from the rear facet of the laser.

The 269-type DFB module is offered in a 14-pin, hermetic butterfly package.

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
Operating Case Temperature Range	T_C	0	75	°C
Storage Case Temperature Range	T_{stg}	–40	85	°C
Laser Forward Bias (TEC on): P_O = 120 mW—150 mW P_O = 160 mW—210 mW P_O = 220 mW—280 mW	I_F	 — — —	 1000 1500 1900	 mA mA mA
Laser Reverse Voltage	V_R	—	2	V
Photodiode Reverse Voltage	V_{RMON}	—	20	V
TEC Current	I_{TEC}	—	2.2	A
TEC Voltage	V_{TEC}	—	5.0	V
Temperature Sensor Current	I_{TS}	—	5	mA
Laser Diode Operating Chip Temperature	T_{LD}	—	40	°C

Handling Precautions

Electrostatic Discharge

CAUTION: This device is susceptible to damage as a result of electrostatic discharge (ESD). Take proper precautions during both handling and testing. Follow guidelines such as *EIA Standard *EIA* 625.**

Agere Systems Inc. employs a human-body model (HBM) for ESD-susceptibility testing and protection-design evaluation. ESD voltage thresholds are dependent on the critical parameters used to define the model. A standard HBM (resistance = 1.5 kΩ, capacitance = 100 pF) is widely used and, therefore, can be used for comparison purposes. The HBM ESD withstand voltage established for the 269-type laser pump module is ±500 V.

* *EIA* is a registered trademark of The Electronic Industries Association.

Electrical/Optical Characteristics

Table 1. Electrical/Optical Characteristics (All performance parameters are specified for $I_{F, OP}$, T_{SET} = 25 °C, T_{CASE} ~ 25 °C, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Optical Power	P_O	—	120	—	280	mW
Wavelength:						
Target Wavelength	λt	—	1420	—	1510	nm
Center Wavelength	λ_C	0 °C—70 °C	λt – 1.0	—	λt + 1.0	nm
RMS Spectral Width:	$\Delta\lambda$	P_O				
Single Mode			—	1.0	5.0	MHz
Multimode			—	0.2	0.3	nm
BOL Operating Laser Forward Current:	$I_{F, OP BOL}$					
P_O = 120 mW		—	—	—	550	mA
P_O = 130 mW		—	—	—	600	mA
P_O = 140 mW		—	—	—	600	mA
P_O = 150 mW		—	—	—	600	mA
BOL Operating Laser Forward Current:	$I_{F, OP BOL}$					
P_O = 160 mW		—	—	—	650	mA
P_O = 170 mW		—	—	—	700	mA
P_O = 180 mW		—	—	—	700	mA
P_O = 190 mW		—	—	—	750	mA
P_O = 200 mW		—	—	—	800	mA
BOL Operating Laser Forward Current:	$I_{F, OP BOL}$					
P_O = 210 mW		—	—	—	850	mA
P_O = 220 mW		—	—	—	900	mA
P_O = 230 mW		—	—	—	950	mA
P_O = 240 mW		—	—	—	1000	mA
P_O = 250 mW		—	—	—	1000	mA
P_O = 260 mW		—	—	—	1100	mA
P_O = 270 mW		—	—	—	1100	mA
P_O = 280 mW		—	—	—	1100	mA
EOL Operating Laser Forward Current	$I_{F, OP EOL}$	—	—	—	1.15 x $I_{F, OP BOL}$	mA
EOL Laser Diode Forward Voltage	V_R	$I_{F, OP}$ EOL	—	2.3	3.0	V
Module Optical Isolation (optional feature)	ISO	EOL Over $T_{CASE RANGE}$	30	—	—	dB
Polarization Extinction Ratio	PER	—	13	—	—	dB
Relative Intensity Noise	RIN	P_O	—	–158	–150	dB/Hz

Table 2. Monitor Photodiode Characteristics (All test parameters are specified for $I_{F, OP}$, T_{SET} = 25 °C, T_{CASE} ~ 25 °C unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Max	Unit
Monitor Diode Current	I_{BF}	—	200	2000	µA
Monitor Diode Dark Current	I_D	V_R = –5 V, I_F = 0	—	100	nA

Electrical/Optical Characteristics (continued)

Table 3. TEC and Thermistor Characteristics (All performance parameters are specified for $I_{F, OP}$, T_{SET} = 25 °C, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Max	Unit
TEC Current:	I_{TEC}	T_{SET} = 25 °C;			
P_O = 120 mW		T_{CASE} = 75 °C;	—	1.6	A
P_O = 130 mW		ΔT = 50 °C, EOL	—	1.6	A
P_O = 140 mW			—	1.6	A
P_O = 150 mW			—	1.6	A
TEC Current:	I_{TEC}	T_{SET} = 25 °C;			
P_O = 160 mW		T_{CASE} = 70 °C;	—	1.7	A
P_O = 170 mW		ΔT = 45 °C, EOL	—	1.7	A
P_O = 180 mW			—	1.7	A
P_O = 190 mW			—	1.7	A
P_O = 200 mW			—	1.7	A
TEC Current:	I_{TEC}	T_{SET} = 25 °C;			
P_O = 210 mW		T_{CASE} = 65 °C;	—	2.0	A
P_O = 220 mW		ΔT = 40 °C, EOL	—	2.0	A
P_O = 230 mW			—	2.0	A
P_O = 240 mW			—	2.0	A
P_O = 250 mW			—	2.0	A
P_O = 260 mW			—	2.0	A
P_O = 270 mW			—	2.0	A
P_O = 280 mW			—	2.0	A
TEC Voltage:	V_{TEC}	T_{SET} = 25 °C;			
P_O = 120 mW		T_{CASE} = 75 °C;	—	3.5	V
P_O = 130 mW		ΔT = 50 °C, EOL	—	3.5	V
P_O = 140 mW			—	3.5	V
P_O = 150 mW			—	3.5	V
TEC Voltage:	V_{TEC}	T_{SET} = 25 °C;			
P_O = 160 mW		T_{CASE} = 70 °C;	—	3.7	V
P_O = 170 mW		ΔT = 45 °C, EOL	—	3.7	V
P_O = 180 mW			—	3.7	V
P_O = 190 mW			—	3.7	V
P_O = 200 mW			—	3.7	V
TEC Voltage:	V_{TEC}	T_{SET} = 25 °C;			
P_O = 210 mW		T_{CASE} = 65 °C;	—	4.2	V
P_O = 220 mW		ΔT = 40 °C, EOL	—	4.2	V
P_O = 230 mW			—	4.2	V
P_O = 240 mW			—	4.2	V
P_O = 250 mW			—	4.2	V
P_O = 260 mW			—	4.2	V
P_O = 270 mW			—	4.2	V
P_O = 280 mW			—	4.2	V
Thermistor Resistance	R_{THERM}	25 °C Laser Diode Set Temperature	9.5	10.5	kΩ
Themistor B Constant	B	—	3700	4100	K

User Information

Table 4. Pin Information

Pin Number	Connection
1	TE Cooler (+)*
2	Thermistor
3	Monitor Anode (–Bias)
4	Monitor Cathode (+Bias)
5	Thermistor
6	No Connect
7	No Connect
8	No Connect
9	No Connect
10	Laser Anode (+)
11	Laser Cathode (–)
12	No Connect
13	Package Ground
14	TEC Cooler (–)

* A positive input into this pin cools the laser.

Fiber Characteristics

- Length of fiber pigtail:
  — 1.75 m ± 0.25 m
- Standard fiber:
  — Cladding OD: 125 μm ± 2 μm
  — Acrylate buffer OD: 250 μm ± 15 μm
  — Cut off wavelength: <1320 nm
- Polarization-maintaining fiber:
  — PANDA
  — Cut off wavelength: <1400 nm
  — Acrylate buffer: 400 μm

Mounting and Connections

CAUTION: This device is susceptible to damage as a result of electrostatic discharge. Proper precautions should be taken during both handling and testing.

The base of the laser module (see Outline Diagram) should be maintained at or below 75 °C (maximum) during operation. Interfaces between the laser module base and heat sink must be clean, and the use of a thermal filler may be necessary.

Mounting Instructions

The minimum fiber bend radius is 1.0 in.

To avoid degradation in performance, mount the module on the board as follows:

1. Place the bottom flange of the module on a flat heat sink at least 0.5 in. x 1.180 in. (12.7 mm x 30 mm) in size. The surface finish of the heat sink should be better than 32 μin. (0.8 μm), and the surface flatness must be better than 0.001 in. (25.4 μm). Using thermal conductive grease is optional; however, thermal performance may be improved if conductive grease is applied between the bottom flange and the heat sink.
2. Mount four #2-56 screws with Fillister heads (M2-3 mm) at the four screw hole locations (see Outline Diagram). The Fillister head diameter must not exceed 0.140 in. (3.55 mm). Do not apply more than 1 in./lb. of torque to the screws.

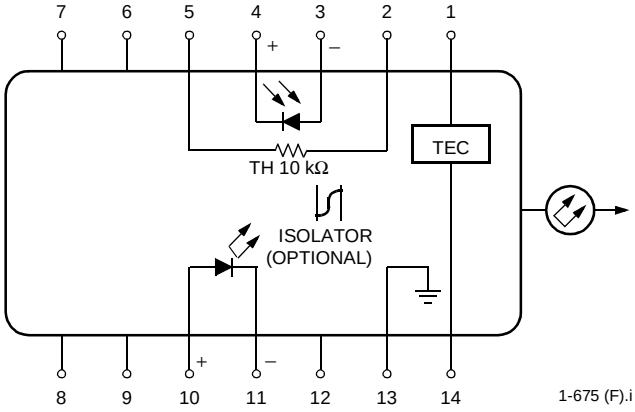
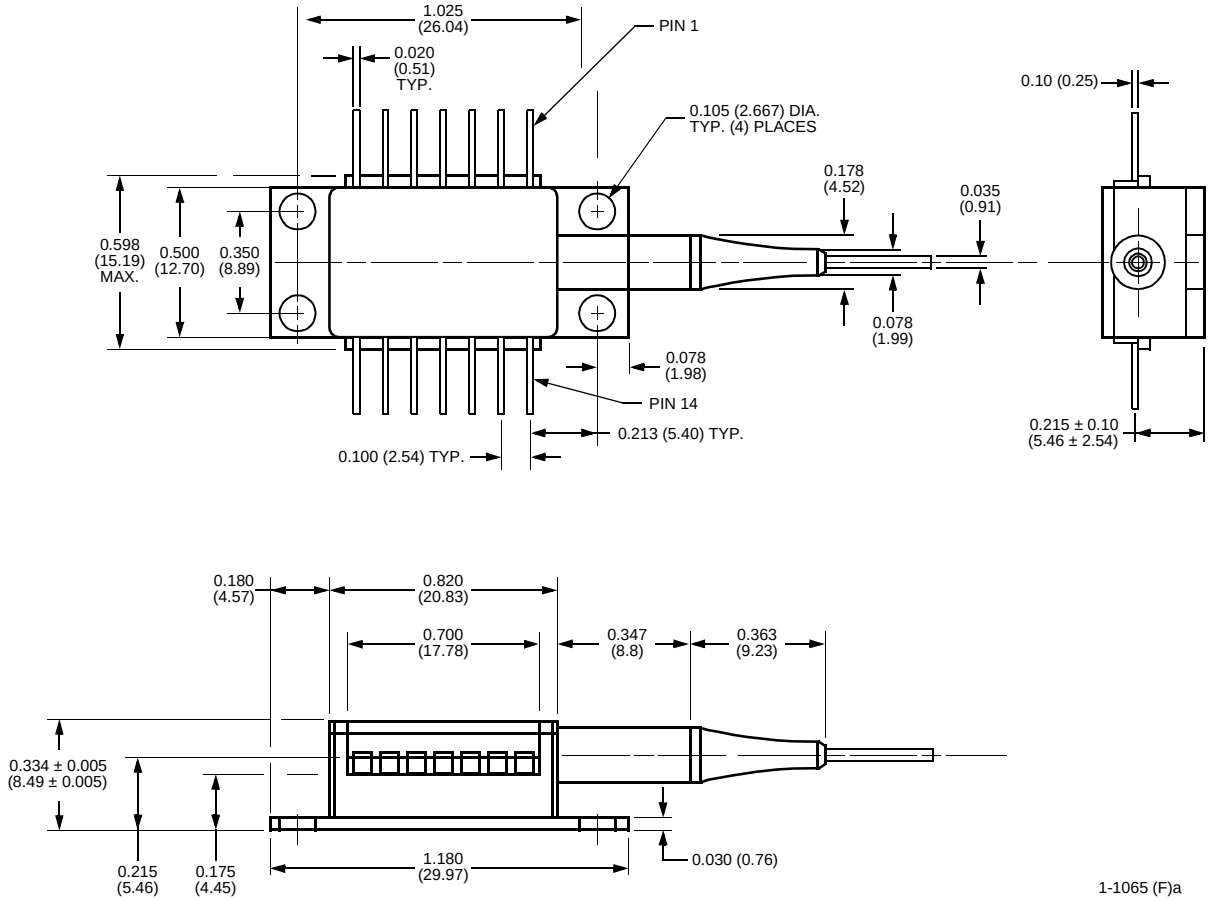


Figure 1. Circuit Schematic

Outline Diagram

Dimensions are in inches and (millimeters).



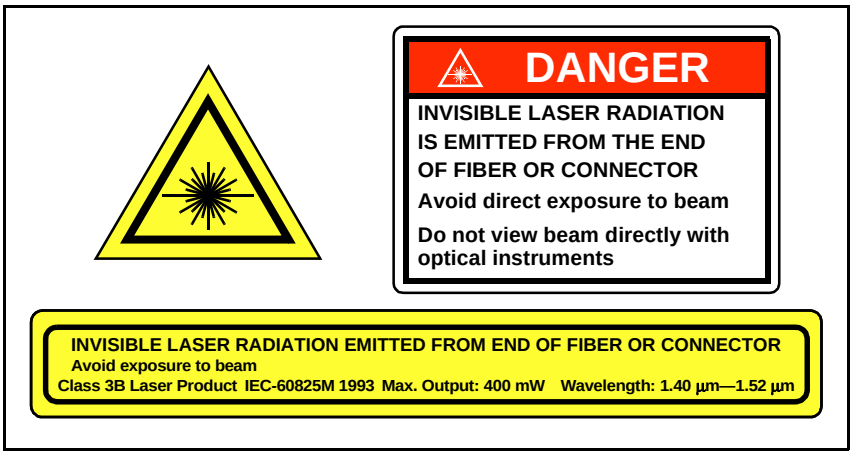
Laser Safety Information

Class IIIb Laser Product

FDA/CDRH Class IIIb laser product. All versions are Class IIIb laser products per CDRH, 21 CFR 1040 Laser Safety requirements. All versions are Class IIIb laser products per *IEC** 60825-1:1993. The device has been classified with the FDA under accession number 8720010.

This product complies with 21 CFR 1040.10 and 1040.11.
8.8 µm/125 µm single-mode fiber pigtail (see Fiber Characteristics, page 5).
Wavelength = 1.40 µm—1.52 µm.
Maximum power = 400 mW.
Because of size constraints, laser safety labeling (including an FDA Class IIIb label) is not affixed to the module but attached to the outside of the shipping carton.
Product is not shipped with power supply.

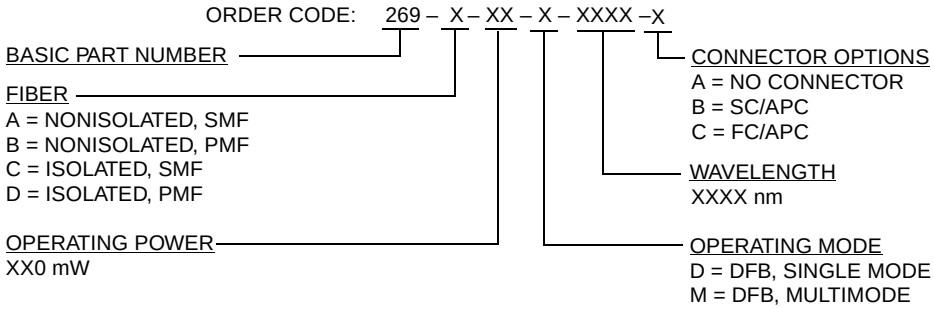
Caution: Use of controls, adjustments, and procedures other than those specified herein may result in hazardous laser radiation exposure.



* *IEC* is a registered trademark of The International Electrotechnical Commission.

Ordering Information

Device Code Information



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