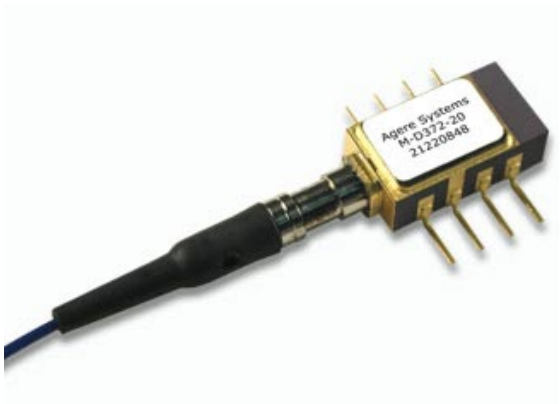
agere systems

Data Sheet
December 2000

D372-Type Digital Uncooled DFB Laser Module for 2.5 Gbits/s Applications



The low-profile D372-Type Laser Module is ideally suited for OC-48 SONET and other high-speed digital applications.

Features

- 8-pin package suitable for SONET applications
- Narrow linewidth, distributed feedback, multiquantum-well (DFB-MQW) 1.3 µm laser with single-mode fiber pigtail
- Choice of wide operating temperature ranges: –40 °C to +85 °C or 0 °C to +85 °C
- No TEC required
- High output power: typical 2.0 mW peak power coupled into single-mode fiber
- Hermetically sealed active components
- Internal back-facet monitor
- Built-in thermistor and bias T
- 25 Ω input impedance
- Internal isolator
- Qualification program: *Telcordia Technologies** TA-983

Applications

- SONET OC-48/STM-16 systems
- Telecommunications
- Secure digital data systems

Benefits

- Easily board mounted
- Gull wing leads
- No additional heat sinks required
- Low-cost alternative to industry-standard, 14-pin isolated laser module (ILM)
- Highly efficient DFB-MQW laser structure allows for lower threshold and drive currents, and reduced power consumption

Description

The D372-type uncooled laser module consists of a laser diode coupled to a single-mode fiber pigtail. The device is available in a standard, 8-pin configuration (see Figure 1 and/or Table 1) and is ideal for long-reach (SONET) and other high-speed digital applications.

The module includes a narrow linewidth (<1 nm), DFB-MQW single-mode laser and an InGaAs PIN photodiode back-facet monitor in a hermetically sealed package.

This package is optimized for a 25 Ω input impedance and allows for dc biasing through an internal bias T. A thermistor has been included for feedback to board-level bias circuitry, if needed.

* *Telcordia Technologies* is a registered trademark of Telcordia Technologies, Inc.

Description (continued)

The device characteristics listed in this document are met at 2.0 mW output power. Higher- or lower-power operation is possible. Under conditions of a fixed photodiode current, the change in optical output is typically ±0.5 dB over an operating temperature range of –40 °C to +85 °C.

This device incorporates the new laser 2000 manufacturing process from the Optoelectronic Products unit of Agere Systems Inc.. Laser 2000 is a low-cost platform that targets high-volume manufacturing and tighter product distributions on all optical subassemblies. This platform incorporates an advanced optical design that is produced on one of the highly automated production lines at the Opotelectronic manufacturing facility. The laser 2000 platform is qualified for the central office and uncontrolled environments, and can be used for applications requiring high performance and low cost.

Table 1. Pin Descriptions

Pin Number	Connection
1	Thermistor
2	Thermistor, package GND
3	Laser dc bias cathode (–) choke
4	Photodiode cathode
5	Photodiode anode
6	Laser diode anode (+)
7	Laser RF input cathode (–) 25 Ω
8	Laser diode anode (+)

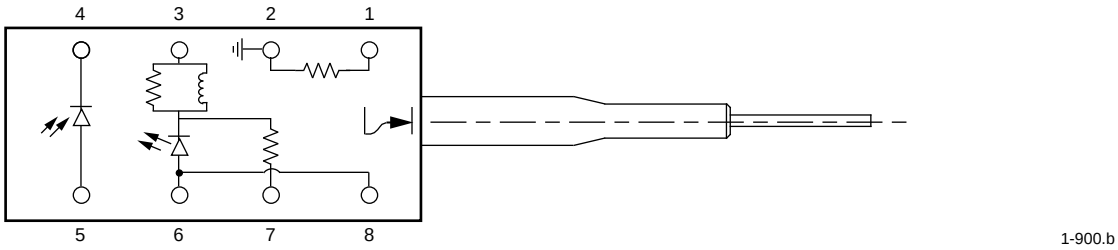


Figure 1. D372-Type Digital Uncooled DFB Mini 8-Pin Laser Module Schematic, Top View

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 operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
Maximum Peak Laser Drive Current or Maximum Fiber Power*	I_{OP} P_{MAX}	— —	150 10	mA mW
Peak Reverse Laser Voltage: Laser Monitor	 V_{RL} V_{RD}	 — —	 2 20	 V V
Monitor Forward Current	I_{FD}	—	2	mA
Operating Case Temperature Range	T_C	–40	85	°C
Storage Case Temperature Range	T_{stg}	–40	85	°C
Lead Soldering Temperature/Time	—	—	260/10	°C/s
Relative Humidity (noncondensing)	RH	—	85	%

* Rating varies with temperature.

Handling Precautions

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 JEDEC Publication No. 108-A (Dec. 1988).

Although protection circuitry is designed into the device, take proper precautions to avoid exposure to ESD.

Electrical/Optical Characteristics

Table 2. D372-20 Electrical/Optical Characteristics (over operating temperature range unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Temperature Range	T	—	–40	—	85	°C
Optical Output Power	P_F	CW, peak	—	2	—	mW
Threshold Current	I_{TH}	T = 25 °C T = full range	5 2	11 —	15 50	mA mA
Modulation Current	I_{MOD}	CW, P_F = 2.0 mW, T = 25 °C CW, I_{MON} = const.,T = full range	13 7.5	20 —	33 55	mA
Slope Efficiency*	SE	CW, P_F = 2.0 mW, T = 25 °C	61	—	154	µW/mA
Center Wavelength	λ_C	P_F = 2.0 mW, CW	1280	—	1335	nm
Spectral Width (–20 dB)	$\Delta\lambda$	P_F = 2.0 mW	—	—	1	nm
Side-mode Suppression Ratio	SMSR	CW, P_F = 2.0 mW	30	40	—	dB
Tracking Error	TE	I_{MON} = constant, CW	—	0.5	1.25	dB
Spontaneous Emission	P_{TH}	I = (0.9) I_{TH}	—	—	50	µW
Rise/Fall Times	t_R, t_F	10%—90% pulse†, T = 25 °C	—	0.125	0.150	ns
Dispersion Penalty	D_P	<60 km, 256 ps/nm	—	—	1.0	dB
Optical Return Loss	ORL	CW	18	—	—	dB
Forward Voltage	V_F	At bias coil	—	1.1	1.6	V
Input Impedance	R	—	—	25	—	Ω
Monitor Current	I_{MON}	V_R‡ = 5 V	100	—	1000	µA
Monitor Dark Current	I_D	V_R‡ = 5 V	—	10	200	nA
Wavelength Temperature Coefficient	—	—	—	0.09	0.1	nm/°C

* The slope efficiency is used to calculate the modulation current for a desired output power. This modulation current plus the threshold current comprise the total operating current for the device.
† Corrected for electrical pulse fall time.
‡ V_R = reverse voltage.

Electrical/Optical Characteristics (continued)

Table 3. D372-21 Electrical/Optical Characteristics (over operating temperature range unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Temperature Range	T	—	0	—	85	°C
Optical Output Power	P_F	CW, peak	—	2	—	mW
Threshold Current	I_{TH}	T = 25 °C T = full range	5 2	11 —	15 50	mA mA
Modulation Current	I_{MOD}	CW, P_F = 2.0 mW, T = 25 °C CW, I_{MON} = const., T = full range	13 7.5	20 —	33 55	mA
Slope Efficiency*	SE	CW, P_F = 2.0 mW, T = 25 °C	61	—	154	μW/mA
Center Wavelength	λ_C	P_F = 2.0 mW, CW	1280	—	1335	nm
Spectral Width (–20 dB)	$\Delta\lambda$	P_F = 2.0 mW	—	—	1	nm
Side-mode Suppression Ratio	SMSR	CW, P_F = 2.0 mW (See Reliability Information, below)	30	—	—	dB
Tracking Error	TE	I_{MON} = constant, CW	—	0.5	1.25	dB
Spontaneous Emission	P_{TH}	I = (0.9) I_{TH}	—	—	50	μW
Rise/Fall Times	t_R, t_F	10%—90% pulse†, T = 25 °C	—	0.125	0.150	ns
Dispersion Penalty	D_P	<60 km, 256 ps/nm (See Reliability Information, below)	—	—	1.0	dB
Optical Return Loss	ORL	CW	18	—	—	dB
Forward Voltage	V_F	At bias coil	—	1.1	1.6	V
Input Impedance	R	—	—	25	—	Ω
Monitor Current	I_{MON}	V_R‡ = 5 V	100	—	1000	μA
Monitor Dark Current	I_D	V_R‡ = 5 V	—	10	200	nA
Wavelength Temperature Coefficient	—	—	—	0.09	0.1	nm/°C

* The slope efficiency is used to calculate the modulation current for a desired output power. This modulation current plus the threshold current comprise the total operating current for the device.
† Corrected for electrical pulse fall time.
‡ V_R = reverse voltage.

Reliability Information

Note, the D372-21 product does not undergo any routine dynamic testing.

A 2000-piece sample was tested at 2.5 Gbits/s for SMSR at 0 °C. In that sample, 99.5% of the devices had SMSR values greater than 30 dB. Within the failures, 90% were for inability to achieve an extinction ration of 10 dB or more.

Surveillance samples are tested to verify that the failure rate has not changed,

Qualification Information

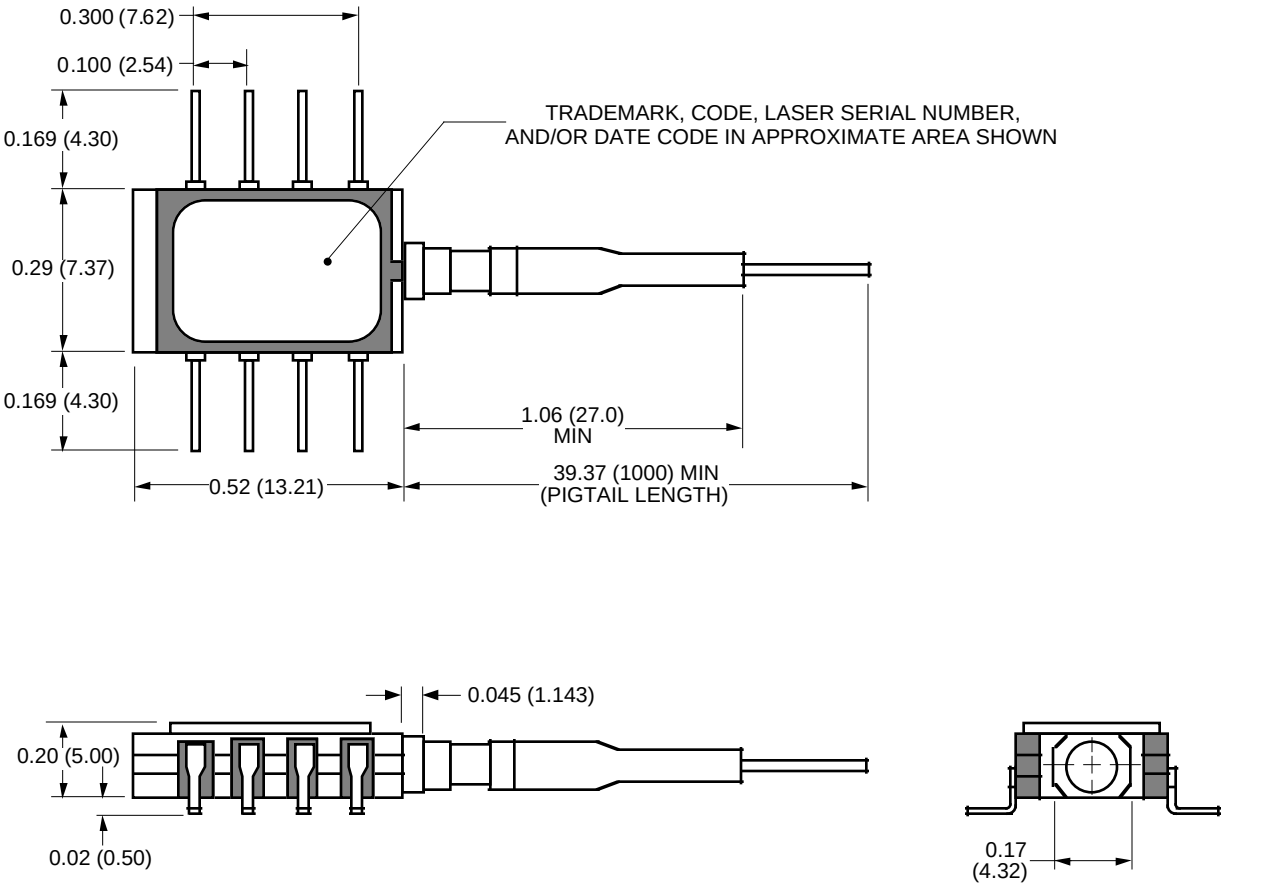
The D372-type laser module is scheduled to complete the following qualification tests and meets the intent of *Telcordia Technologies* TR-NWT-000468 for interoffice environments and TA-TSY-000983 for outside plant environments.

Table 4. D372-Type Laser Module Qualification Test Plan

Qualification Test	Conditions	Sample Size	Reference
Mechanical Shock	500 G	11	MIL-STD-883 Method 2002
Vibration	20 g, 20 Hz—2,000 Hz	11	MIL-STD-883 Method 2007
Solderability	—	11	MIL-STD-883 Method 2007
Thermal Shock	Delta T = 100 °C	11	MIL-STD-883 Method 2003
Fiber Pull	1 kg; 3 times	11	*Telcordia Technologies* 983
Accelerated (Biased) Aging	85 °C, 5,000 hrs.	25	*Telcordia Technologies* 983, Section 5.18
High-temperature Storage	85 °C, 2,000 hrs.	11	*Telcordia Technologies* 983
Temperature Cycling	500 cycles	11	*Telcordia Technologies* 983, Section 5.20
Cyclic Moisture Resistance	10 cycles	11	*Telcordia Technologies* 983, Section 5.23
Damp Heat	40 °C, 95% RH, 1344 hrs.	11	MIL-STD-202 Method 103
Internal Moisture	<5,000 ppm water vapor	11	MIL-STD-883 Method 1018
Flammability	—	—	TR357 Section 4.4.2.5
ESD Threshold	—	6	*Telcordia Technologies* 983, Section 5.22

Outline Diagram

Dimensions are in inches and (millimeters).Laser Safety Information



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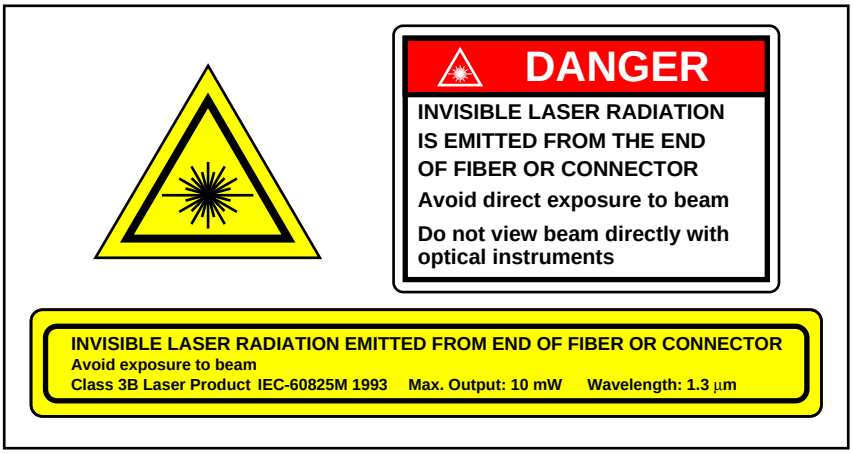
Class IIIb Laser Product

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 3B 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.
8.3 µm single-mode pigtail or connector
Wavelength = 1.3 µm
Maximum power = 10 mW

Because of size constraints, labeling 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

Table 5. D372-20 Ordering Information

Device Code*	Comcode	Pfiber	Connector
D372-20AS	108088048	2.0 mW	SC-PC
D372-20BS	108224973	2.0 mW	SC-APC
D372-20FS	108130469	2.0 mW	FC-PC
D372-20GS	108332032	2.0 mW	FC-APC

* Trailing S in code indicates that the module contains an isolator.

Table 6. D372-21 Type Ordering Information

Device Code*	Comcode	Pfiber	Connector
D372-21AS	108898073	2.0 mW	SC-PC
D372-21BS	108898081	2.0 mW	SC-APC
D372-21FS	108898099	2.0 mW	FC-PC
D372-21GS	108898107	2.0 mW	FC-APC
D372-21SS	108898114	2.0 mW	FC-APC

* Trailing S in code indicates that the module contains an isolator.

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