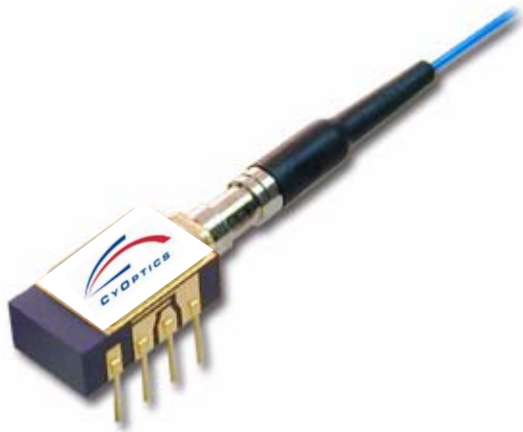


A371-Type Analog, Uncooled, Isolated DFB Laser Module



The low-profile A371-type analog laser module is ideally suited for CATV applications.

Features

- Eight-pin package suitable for CATV applications
- Narrow linewidth, distributed-feedback, multi-quantum-well (DFB-MQW) 1.3 μm laser with single-mode fiber pigtail
- Wide operating temperature range: $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$
- Frequency range up to 1.0 GHz
- No thermoelectric cooler required
- Single- and double-isolated versions available
- High output power: typically 2.0 mW peak power coupled into single-mode fiber
- Hermetically sealed active components
- Internal back-facet monitor
- Qualification program: *Telcordia Technologies*[™] TA-983

Applications

- Video and data applications
- Downstream telephony and data
- Return path systems
- Mixed analog and digital modulation
- Telecommunications

Benefits

- Easily board mounted
- Requires no lead bending
- No additional heat sinks required
- Highly efficient DFB-MQW laser structure allows for lower threshold and drive currents, and reduced power consumption
- High output power allows for longer system spans, more fiber splits, and greater tolerance of fiber and connector quality
- Internal isolator minimizes spurious noise

Description

The A371-type uncooled isolated 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 CATV 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.

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 CyOptics Laser 2000 manufacturing process. Laser 2000 is a low-cost platform that targets high-volume manufacturing and tight product distributions on all optical subassemblies. This platform incorporates an advanced optical design that is produced on highly automated production lines. The Laser 2000 platform is qualified for central office and uncontrolled environments, and can be used for applications requiring high performance and low cost.

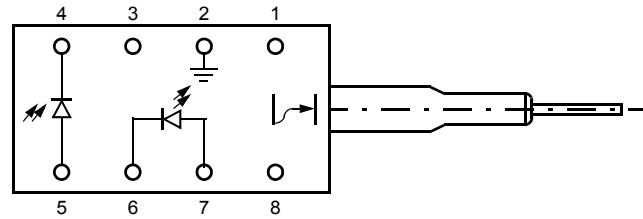


Figure 1. A371-Type Analog Uncooled Isolated DFB Laser Module Schematic, Top View

Table 1. Pin Descriptions

Pin Number	Connection
1	NC
2	Case ground
3	NC
4	Photodiode cathode
5	Photodiode anode
6	Laser diode cathode
7	Laser diode anode
8	NC

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	V _{RL}	—	2	V
Monitor	V _{RD}	—	20	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).

CyOptics 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 k Ω , capacitance = 100 pF) is widely used and can be used for comparison purposes.

Laser Safety Information

Class IIIb Laser Product

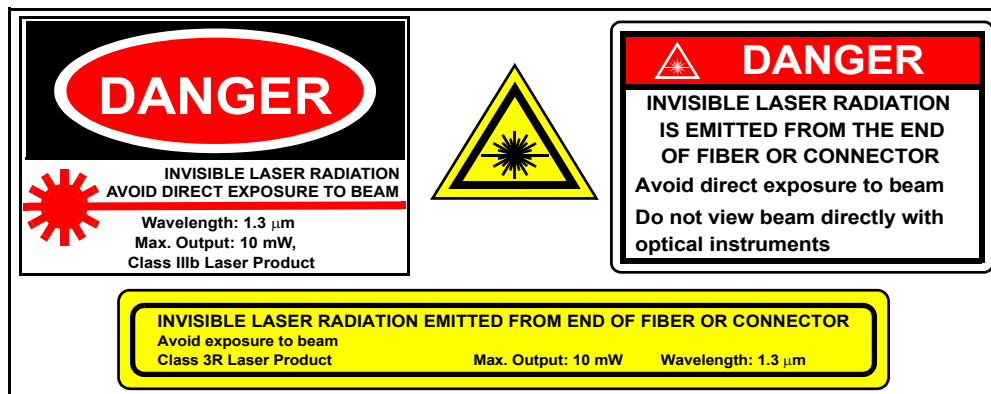
FDA/CDRH Class IIIb laser product. All versions are Class IIIb laser products per CDRH, 21 CFR 1040 Laser Safety requirements. All versions are classified Class 3B laser products consistent with IEC[®] 60825-1: 1993. This device family has been classified with the FDA under accession number 8720010. Measurements were made to classify the product per IEC 60825-1: 1993.

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, laser safety 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.



Electrical/Optical Characteristics

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Temperature Range	T _{OP}	—	-40	—	85	°C
Optical Output Power	P _F	CW, nominal	—	2	—	mW
Threshold Current	I _{TH}	T = 25 °C T = full range	5 2	11 —	15 50	mA mA
Drive Current Above Threshold	I _{MOD}	CW, P _F = 2.0 mW, T = 25 °C CW, I _{MON} = const., T = full range	10 7.5	20 —	30 55	mA
Slope Efficiency	SE	CW, P _F = 2.0 mW, T = 25 °C	67	—	200	μW/mA
Center Wavelength	λ _C	P _F = 2.0 mW, CW	1280	—	1335	nm
Spectral Width (-20 dB)	Δλ	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
Forward Voltage	V _F	CW	—	1.1	1.6	V
Input Impedance	R	—	3	—	8	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

* V_R = reverse voltage.

Electrical/Optical Characteristics (continued)

Analog Operation

The A371-type laser module can be used in a wide variety of analog operations. These may include several channels of pure video signals, or a mix of video signals with digital data channels riding on analog carriers. It is difficult to prepare a single battery of testing conditions that will satisfy all applications. The following table contains a set of testing conditions that CyOptics believes will give a broad indication of the performance of the A371 series laser module.

The distortion characteristics are measured using a two-tone test. The frequencies are 13 MHz and 19 MHz. The second-order distortion components are measured at $f_1 + f_2 = 32$ MHz and $f_1 - f_2 = 6$ MHz. All third-order distortion components are measured in the frequency range of 5 MHz—200 MHz, and they meet the required level.

Table 3. Analog Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Power	P _O	CW, T = -40 °C to +85 °C	—	2.0	—	mW
Relative Intensity Noise	RIN	CW, P _F = 2.0 mW, Freq. = 5 MHz to 300 MHz; no fiber loss, T = 25 °C	—	-155	-145	dB/Hz
Modulation Bandwidth	BW	-3 dB, P _F = 2.0 mW, T = -40 °C to +85 °C	1.0	—	—	GHz
Second-order Distortions	—	T = 25 °C, P _F = 2.0 mW, OMI = 0.2; Two-tone test: f ₁ = 13 MHz, f ₂ = 19 MHz; 20 km of fiber, (7 dB loss) plus connector loss, f ₁ ± f ₂	—	-54 -58* -46	-50 -54* -42†	dBc dBc dBc
Third-order Distortions	—	T = 25 °C, P _F = 2.0 mW, OMI = 0.2; Two-tone test: f ₁ = 13 MHz, f ₂ = 19 MHz; 20 km of fiber (7 dB loss), plus connector loss, all peaks from 5 MHz—50 MHz meet this level	—	-70 -75* -69	-63 -68* -61†	dBc dBc dBc
Spurious Noise	N _{SP}	T = 25 °C, P _F = 2.0 mW, OMI = 0.2; ref. to one-tone: 5 MHz to 50 MHz, 20 km of fiber, (7 dB loss) plus connector loss	—	-63 -61	-60‡ -58†	dBc dBc
Spurious Noise (carrier off)	N _{SP}	T = 25 °C, P _F = 2.0 mW	—	-50 -54* -45	-45 -50* -40†	dBc dBc dBc
RF Bandpass Flatness	B _{PF}	Peak to valley, 5 MHz to 200 MHz	—	—	1.0	dB

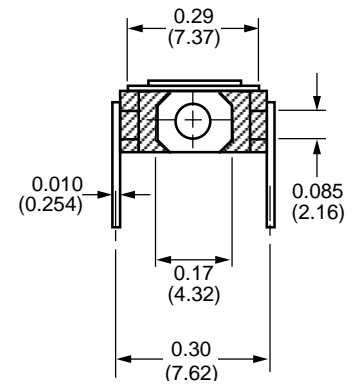
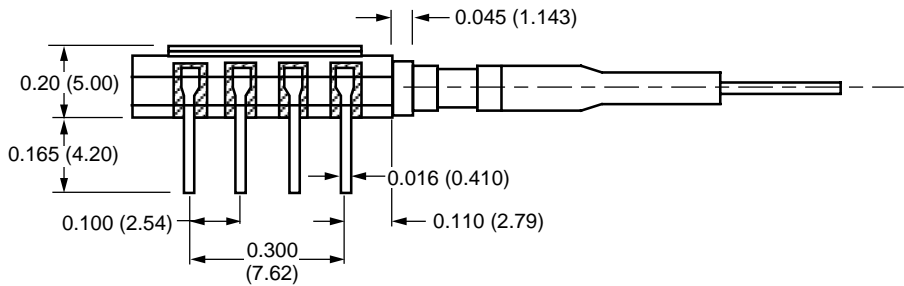
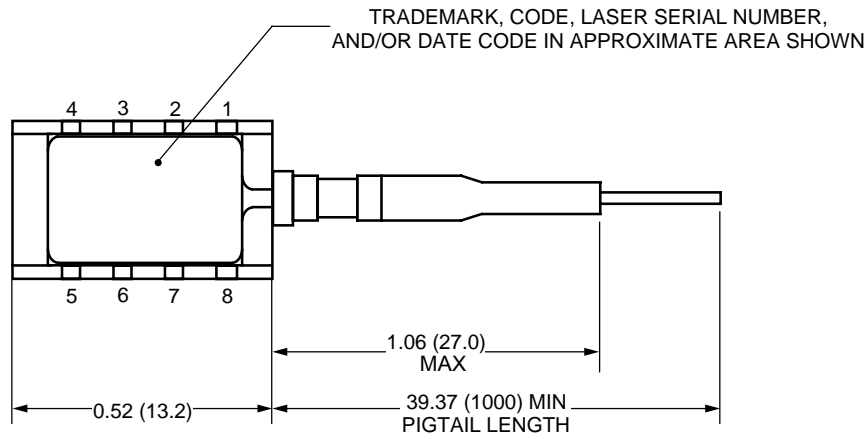
* Double-isolated version (see Table 5 for ordering information).

† Low-performance option

‡ Single- and double-isolated versions.

Outline Diagram

Dimensions are in inches (and millimeters).



Qualification Information

The A371-type laser module has completed and passed 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. A371-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	<i>Telcordia Technologies</i> 983
Accelerated (Biased) Aging	85 °C, 5,000 hrs.	25	<i>Telcordia Technologies</i> 983 Section 5.18
High-temperature Storage	85 °C, 2,000 hrs.	11	<i>Telcordia Technologies</i> 983
Temperature Cycling	500 cycles	11	<i>Telcordia Technologies</i> 983 Section 5.20
Cyclic Moisture Resistance	10 cycles	11	<i>Telcordia Technologies</i> 983 Section 5.23
Damp Heat	40 °C, 95% RH, 1,344 hrs.	11	MIL-STD-202 Method 103
Internal Moisture	<5,000 ppm water vapor	11	MIL-STD-883 Method 1018
Flammability	—	—	TR357 Sec. 4.4.2.5
ESD Threshold	—	6	<i>Telcordia Technologies</i> 983 Section 5.22

Ordering Information

Table 5. Ordering Information

Device Code	Comcode	Pfiber	Connector	Performance Option
A371-20AS	108053307	2.0 mW	SC-PC	Single Isolator
A371-20BS	108173956	2.0 mW	SC-APC	Single Isolator
A371-20FS	108120445	2.0 mW	FC-PC	Single Isolator
A371-20GS	108130444	2.0 mW	FC-APC	Single Isolator
A371-20NS	108043522	2.0 mW	none	Single Isolator
A371-22AD	108348699	2.0 mW	SC-PC	Double Isolator
A371-22BD	108348707	2.0 mW	SC-APC	Double Isolator
A371-22FD	108348715	2.0 mW	FC-PC	Double Isolator
A371-22GD	108348723	2.0 mW	FC-APC	Double Isolator
A371-22ND	108348731	2.0 mW	none	Double Isolator
A371-24AS	108401019	2.0 mW	SC-PC	Low Performance
A371-24BS	108401027	2.0 mW	SC-APC	Low Performance
A371-24FS	108401035	2.0 mW	FC-PC	Low Performance
A371-24GS	108401043	2.0 mW	FC-APC	Low Performance
A371-24NS	108401050	2.0 mW	none	Low Performance

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IEC is a registered trademark of The International Electrotechnical Commission.

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October 2005
DS06-002 (Replaces DS05-002)

