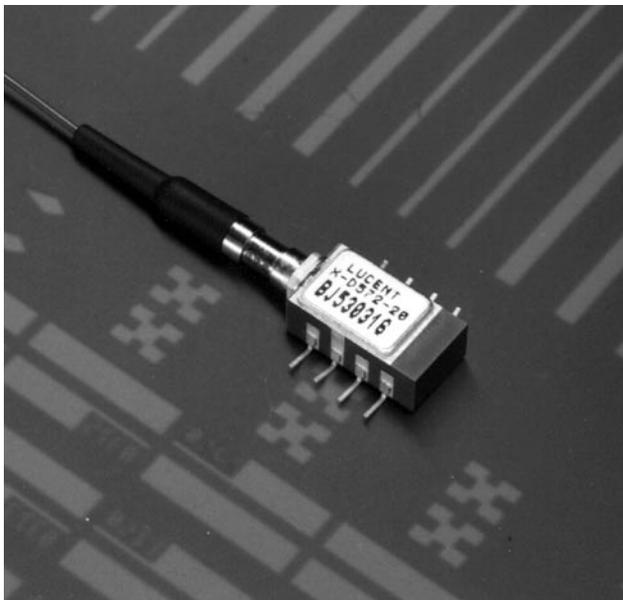




D572-Type 1.5 μm Uncooled DFB *FastLight*TM Laser Module for 2.5 Gbits/s and High Bandwidth Applications



The low-profile D572-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, multi-quantum-well (DFB-MQW) 1510 nm or 1550 nm laser with single-mode fiber pigtail
- Operating temperature range: $-25\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$ ($-25\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ versions under development)
- 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
- $25\ \Omega$ input impedance
- Internal isolator
- *Telcordia Technologies** TA-983 qualification program
- Bandwidth $> 3\text{ GHz}$

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 D572-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 ($< 1\text{ nm}$) DFB-MQW single-mode laser and an InGaAs PIN photodiode back-facet monitor in a hermetically sealed package.

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

* *Telcordia Technologies* is a trademark of Bell Communications Research, Inc.

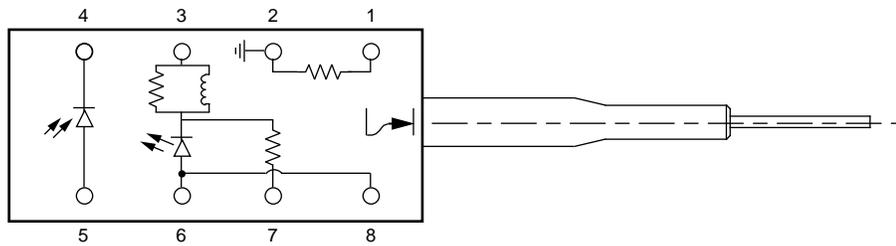
Description (continued)

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 -25 $^{\circ}\text{C}$ to $+70$ $^{\circ}\text{C}$.

This device incorporates the new Laser 2000 manufacturing process from the Optoelectronic Products unit of Lucent Technologies Microelectronics Group. 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 Optoelectronic 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 (+)



1-900.b

Figure 1. D572-Type 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_{OF} P_{MAX}	—	150 10	mA mW
Peak Reverse Laser Voltage:				
Laser	V_{RL}	—	2	V
Monitor	V_{RM}	—	20	V
Monitor Forward Current	I_{FD}	—	2	mA
Operating Case Temperature Range	T_C	-40	85	$^{\circ}\text{C}$
Storage Case Temperature Range	T_{stg}	-40	85	$^{\circ}\text{C}$
Lead Soldering Temperature/Time	—	—	260/10	$^{\circ}\text{C/s}$
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 EIA * Standard EIA-625.

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

* EIA is a registered trademark of Electronic Industries Association.

Electro-Optical Characteristics

Table 2. Electro-Optical Characteristics (over operating temperature range unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Temperature Range	T	—	-25	—	70	$^{\circ}\text{C}$
Optical Output Power	P_F	CW, peak	—	2	—	mW
Threshold Current	I_{TH}	$T = 25^{\circ}\text{C}$ T = full range	5 2	11 —	15 60	mA mA
Modulation Current	I_{MOD}	CW, $P_F = 2.0\text{ mW}$, $T = 25^{\circ}\text{C}$ CW, $I_{MON} = \text{constant}$, T = full range	15 7.5	25 —	35 60 ¹	mA mA
Slope Efficiency ²	SE	CW, $P_F = 2.0\text{ mW}$, $T = 25^{\circ}\text{C}$	57	—	133	$\mu\text{W}/\text{mA}$
Center Wavelength ³	λ_C	$P_F = 2.0\text{ mW}$, CW	1530	1550	1570	nm
Spectral Width (-20 dB)	$\Delta\lambda$	$P_F = 2.0\text{ mW}$	—	—	1	nm
Side-mode Suppression Ratio	SMSR	CW, $P_F = 2.0\text{ mW}$	30	40	—	dB
Tracking Error	TE	$I_{MON} = \text{constant}$, CW	—	—	1.5	dB
Spontaneous Emission	P_{TH}	$I = (0.9) I_{TH}$	—	—	100	μW
Rise/Fall Times	t_R, t_F	10%—90% pulse ⁴ , $T = 25^{\circ}\text{C}$	—	0.125	0.175	ns
Dispersion Penalty	DP	1200 ps/nm—1600 ps/nm; typical, 1350 ps/nm	—	—	2.0	dB
Optical Return Loss	ORL	CW	18	—	—	dB
Forward Voltage	V_F	At bias coil	—	1.0	1.6	V
Input Impedance	R	—	—	25	—	Ω
Monitor Current	I_{MON}	$V_R^5 = 5\text{ V}$	100	—	1000	μA
Monitor Dark Current	I_D	$V_R^5 = 5\text{ V}$	—	10	200	nA
Wavelength Temperature Coefficient	—	—	—	0.09	0.12	nm/ $^{\circ}\text{C}$

1. BOL value; EOL = 80 mA.

2. 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.

3. 1510 nm wavelength also available.

4. Corrected for electrical pulse fall time.

5. V_R = reverse voltage.

Qualification Information

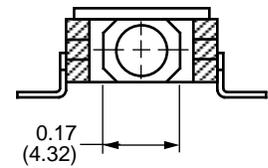
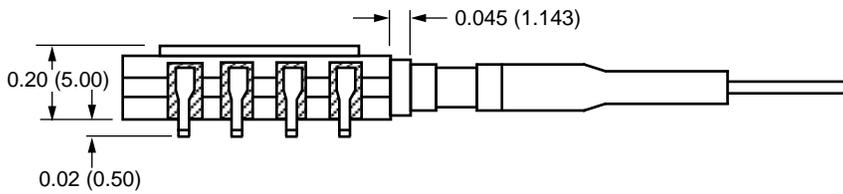
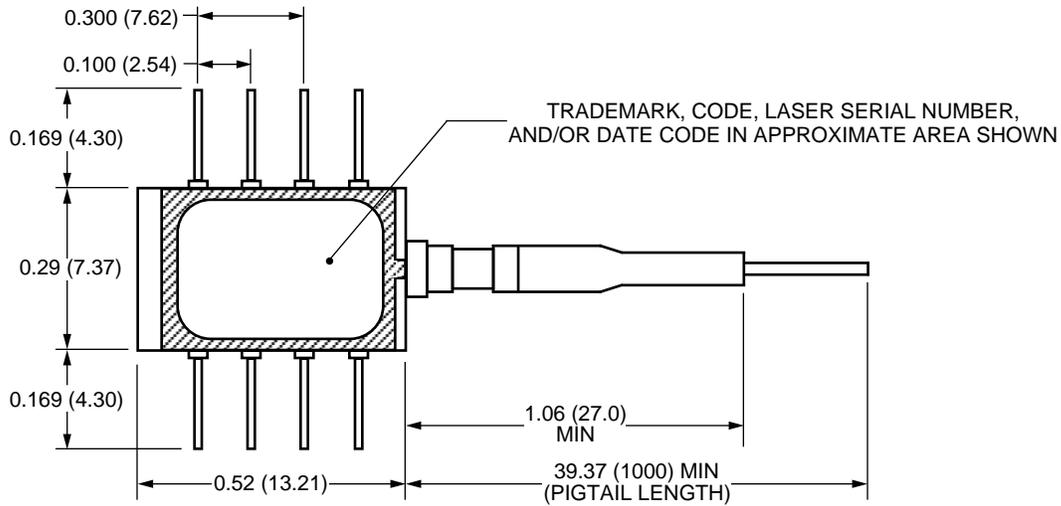
The D572-Type Laser Module is scheduled to complete the following qualification tests and meets the intent of *Telcordia Technologies* TR-NWT-000468 for interoffice environments and TA-TSY-000983 for outside plant environments.

Table 3. D572-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	Bellcore 983
Accelerated (Biased) Aging	85 °C, 5,000 hrs.	25	Bellcore 983 Section 5.18
High-temperature Storage	85 °C, 2,000 hrs.	11	Bellcore 983
Temperature Cycling	500 cycles	11	Bellcore 983 Section 5.20
Cyclic Moisture Resistance	10 cycles	11	Bellcore 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	Bellcore 983 Section 5.22

Outline Diagram

Dimensions are in inches and (millimeters).



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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 certified 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 = 1.5 μm

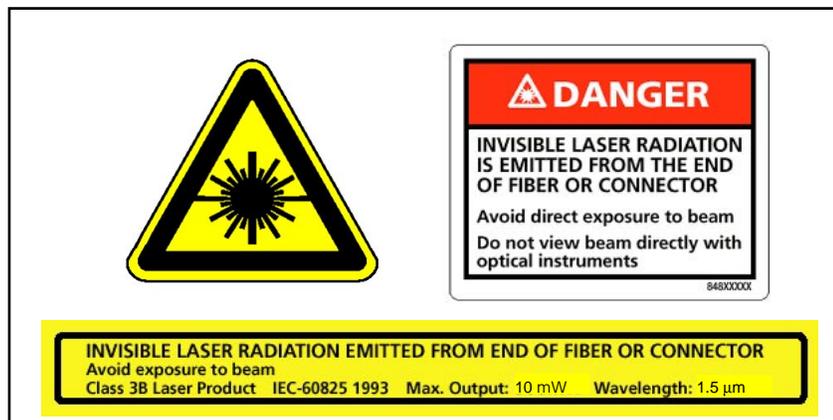
Maximum power = 10 mW

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.

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



Ordering Information

Device Code*	Comcode	Pfiber	Wavelength	Connector†	Operating Case Temperature Range (°C)
D572-20AS	108401290	2.0 mW	1550 nm	SC-PC	-25 to +70
D572-20BS	108401308	2.0 mW	1550 nm	SC-APC	-25 to +70
D572-20FS	108401316	2.0 mW	1550 nm	FC-PC	-25 to +70
D572-20GS	108401324	2.0 mW	1550 nm	FC-APC	-25 to +70
D572-20NS	108401332	2.0 mW	1550 nm	none	-25 to +70
D572-20SS	108669565	2.0 mW	1550 nm	LC	-25 to +70
D572-22AS	108401340	2.0 mW	1550 nm	SC-PC	-5 to +70
D572-22BS	108401357	2.0 mW	1550 nm	SC-APC	-5 to +70
D572-22FS	108401365	2.0 mW	1550 nm	FC-PC	-5 to +70
D572-22GS	108401373	2.0 mW	1550 nm	FC-APC	-5 to +70
D572-22NS	108401381	2.0 mW	1550 nm	none	-5 to +70
D572C20AS	108469842	2.0 mW	1510 nm	SC	-25 to +70
D572C20BS	108469859	2.0 mW	1510 nm	SC-APC	-25 to +70
D572C20FS	108469867	2.0 mW	1510 nm	FC-PC	-25 to +70
D572C20GS	108469875	2.0 mW	1510 nm	FC-APC	-25 to +70
D572C20NS	108469883	2.0 mW	1510 nm	none	-25 to +70
D572C20SS	—	2.0 mW	1510 nm	LC	-25 to +70
D572C22AS	108469891	2.0 mW	1510 nm	SC	-5 to +70
D572C22BS	108469909	2.0 mW	1510 nm	SC-APC	-5 to +70
D572C22FS	108469917	2.0 mW	1510 nm	FC-PC	-5 to +70
D572C22GS	108469925	2.0 mW	1510 nm	FC-APC	-5 to +70
D572C22NS	108469933	2.0 mW	1510 nm	none	-5 to +70
D572C22SS	—	2.0 mW	1510 nm	LC	-5 to +70

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

† Connectors will meet *Telcordia Technologies* GR-326-CORE.

For additional information, contact your Microelectronics Group Account Manager or the following:

INTERNET: <http://www.lucent.com/micro>, or for Optoelectronics information, <http://www.lucent.com/micro/opto>

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CHINA: Microelectronics Group, Lucent Technologies (China) Co., Ltd., A-F2, 23/F, Zao Fong Universe Building, 1800 Zhong Shan Xi Road, Shanghai 200233 P. R. China **Tel. (86) 21 6440 0468, ext. 316**, FAX (86) 21 6440 0652

JAPAN: Microelectronics Group, Lucent Technologies Japan Ltd., 7-18, Higashi-Gotanda 2-chome, Shinagawa-ku, Tokyo 141, Japan
Tel. (81) 3 5421 1600, FAX (81) 3 5421 1700

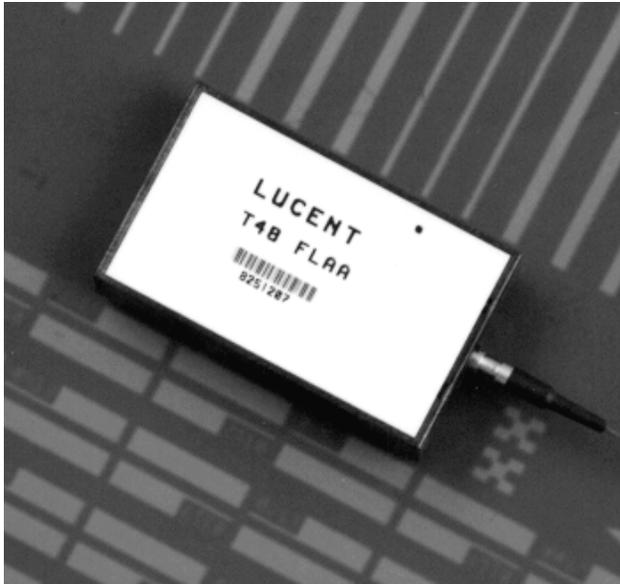
EUROPE: Data Requests: MICROELECTRONICS GROUP DATALINE: **Tel. (44) 7000 582 368** FAX (44) 1189 328 148
Technical Inquiries: OPTOELECTRONICS MARKETING: **(44) 1344 865 900** (Ascot UK)

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T48-Type 1300 nm and 1500 nm Uncooled 2.5 Gbits/s Laser Transmitters



Offering multiple output power options and SONET/SDH compatibility, the T48-Type Uncooled Laser Transmitters are manufactured in a 24-pin plastic DIP with a single-mode fiber pigtail.

Features

- Multisource compliant
- Data rates to 2.5 Gbits/s
- SONET and ITU-T compliant at OC-48 and STM-16
- Uncooled, field-proven InGaAsP MQW laser
- 1300 nm and 1500 nm versions
- Clocked or nonclocked operation with single-ended or differential inputs
- 50 Ω ac-coupled ECL or PECL compatible data and clock inputs
- Operation from single +5 V or -5 V power supply
- Low-profile, 24-pin nonconductive package
- Automatic power control
- Wide operating case temperature range, -40 °C to +85 °C

- Laser back-facet monitor output
- Transmitter-disable input
- FC-PC or SC connectors

Applications

- Telecommunications:
 - SONET/SDH SR/IR/LR
 - Subscriber loop
 - Metropolitan area networks
- High-speed data communication

Description

The T48-Type 2.5 Gbits/s Laser Transmitters are designed for use in transmission systems and high-speed data communication applications. The transmitter operates at the SONET OC-48 rate, as well as the ITU-T SDH rate of STM-16.

The transmitters meet all present *Telcordia Technologies** GR-253CORE requirements and the ITU-T G.957 and G.958 recommendations. They are also ideally suited for extended-distance data and networking applications.

Manufactured in a 24-pin, plastic-encased DIP, the transmitter incorporates an InGaAs PIN photodiode back-facet monitor, a GaAs laser driver IC, and a choice of lasers, including:

- 1300 nm hermetic Fabry-Perot laser (T481 versions)
- 1300 nm hermetic MQW isolated DFB laser (T483 versions)
- 1550 nm hermetic MQW isolated DFB laser (T485 versions)

The transmitter requires a single power supply (+5 V or -5 V). A clock input can be enabled for those applications where jitter is critical.

Pin information is listed in Table 1.

* *Telcordia Technologies* is a trademark of Bell Communications Research, Inc.

Transmitter Processing

The transmitter can withstand normal wave soldering processes. The complete transmitter module is not hermetically sealed; therefore, it should not be immersed in or sprayed with any cleaning solution or solvents. The process cap and fiber-pigtail jacket can deform at temperatures greater than 85 °C. The transmitter pins can be wave-soldered at maximum temperature of 250 °C for 10 seconds.

Installation Considerations

Although the transmitter has been designed with ruggedness in mind, care should be used during handling. The optical connector should be kept free from dust, and the process cap should be kept in place as a dust cover when the device is not connected to a cable. If contamination is present on the optical connector, the use of canned air with an extension tube should remove any debris. Other cleaning procedures are identified in the *Cleaning Fiber-Optic Assemblies* Technical Note (TN95-010LWP).

Connector Options

The standard fiber-optic pigtail is an 8 μm core single-mode fiber in a 0.036 in. (914 μm) diameter, tight-buffered outer jacket. The standard length is 39 in. ± 4 in. (1 m ± 10 cm) and can be terminated with either an SC or FC/PC optical connector. Other connector options may be available on special order. Please contact your Lucent Technologies Account Manager for ordering information.

Table 1. Pin Descriptions

Pin Number	Name
1	VEE
2	BF Monitor *
3	Bias Monitor*
4	Tx Disable
5	Clock Select
6	Ground
7	NUC†
8	NUC†/Laser Degrade Alarm (future option)
9	NUC†
10	NUC†
11	Ground
12	VEE
13	Vcc
14	NUC†
15	Ground
16	DATA
17	Ground
18	DATA
19	Ground
20	Clock
21	Ground
22	Clock
23	Ground
24	Vcc

* Laser back-facet and bias monitor functions are customer-use options that are not required for normal operations of the transmitter. They are normally used during manufacture and for diagnostics.

† Pins designated no user connection (NUC) cannot be tied to ground or any other circuit potential.

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
Supply Voltage*	—	—	5.5	V
Operating Case Temperature Range	T _c	-40	85	°C
Storage Case Temperature Range	T _{stg}	-40	85	°C
Lead Soldering Temperature/Time	—	—	250/10	°C/s
Relative Humidity (noncondensing)	RH	—	85	%
Minimum Fiber Bend Radius	—	1.00 (25.4)	—	in. (mm)

* With V_{EE} connected to -5 V, V_{CC} must be at 0 V; with V_{CC} connected to +5 V, V_{EE} must be at 0 V.

Characteristics

Minimum and maximum values specified over operating case temperature range at 50% duty cycle data signal. Typical values are measured at room temperature unless otherwise noted.

Table 2. Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
dc Power Supply Voltage ¹	V	4.75	5.0	5.25	V
dc Power Supply Current Drain	I	—	180	300	mA
Input Data/Clock Voltage: ^{2, 3}					
Single-ended Input	V _{IN}	600	800	1000	mVp-p
Differential Input	V _{IN}	300	400	500	mVp-p
Clocked/Nonclocked Select Voltage: ⁴					
Clocked Operation (active-low)	V _{SEL_CLK}	V _{EE}	—	V _{EE} + 0.8	V
Nonclocked Operation	V _{SEL_CLK}	V _{CC} - 2.0	—	V _{CC}	V
Input Impedance	R _{IN}	—	50	—	Ω
Transmitter Disable Voltage ⁵	V _{DIS}	V _{CC} - 2.0	—	V _{CC}	V
Transmitter Enable Voltage (enabled low)	V _{EN}	V _{CC} - 2.0	—	V _{EE} + 0.8	V
Laser Bias Voltage ⁶	V _B	0	200	1600	mV
Back-facet Monitor Voltage (50% duty cycle)	V _{BF}	460	500	540	mV
Set-up Time (See Figure 1.)	t _{SET}	—	—	70	ps
Hold Time (See Figure 1.)	t _{HOLD}	70	—	—	ps

1. With V_{EE} connected to -5 V, V_{CC} must be at 0 V; with V_{CC} connected to +5 V, V_{EE} must be at 0 V.

2. Inputs are ac-coupled into an equivalent input impedance of 50 Ω.

3. Single-ended or differential operation may be used. If the inputs are driven single-ended, the unused inputs must be ac-coupled (0.1 μF) to ground.

4. Clocked operation is optional. For clocked operation, pin 5 must be tied to V_{EE}. With clocked operation, the optical output changes state with the rising edge of the input clock signal. If left unconnected, the pin will be pulled low, enabling the clock mode.

5. The transmitter is normally enabled and only requires an external voltage to disable.

6. This voltage is measured from pin 3 to V_{EE} and is converted to laser bias current with the ratio of 20 mV/mA.

Characteristics (continued)

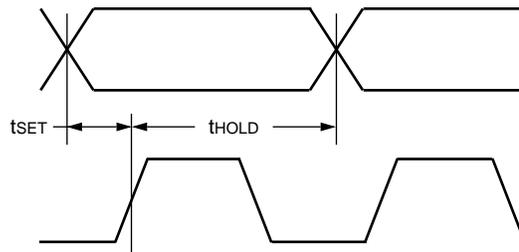


Figure 1. Electrical Input/Output Interface Timing Diagram

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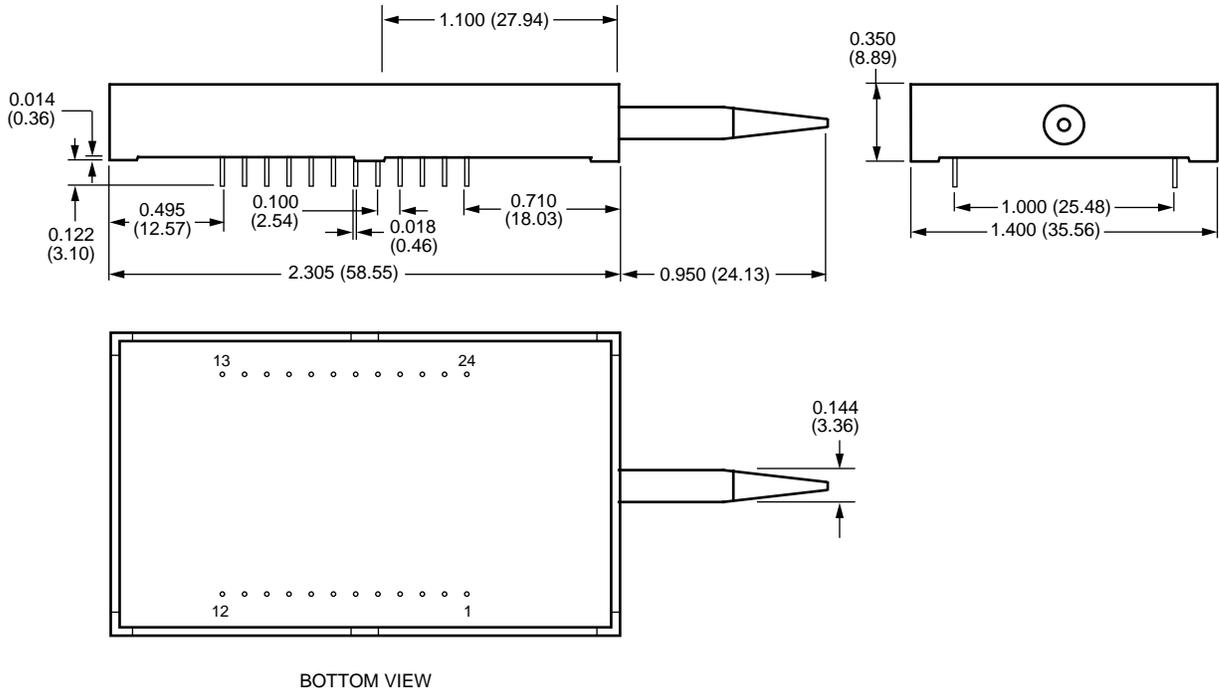
Table 3. Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Average Power Output: ¹					
T481xLAA	P _o	-10	-5	-3	dBm
T483xFAA, T485xFAA	P _o	-5	-2	0	dBm
T483xDAA, T485xDAA	P _o	-2	0	2	dBm
Center Wavelength Range:					
T481xLAA	λ	1266	—	1360	nm
T483xFAA	λ	1270	—	1360	nm
T483xDAA	λ	1280	—	1335	nm
T485xFAA	λ	1430	—	1580	nm
T485xDAA	λ	1500	—	1580	nm
Spectral Width (T481 Version, F-P Laser)	$\Delta\lambda_{RMS}$	—	—	4	nm
Spectral Width (T483/ T485 Versions, DFB Laser) ²	$\Delta\lambda_{20}$	—	—	1	nm
Wavelength Shift with Temperature:					
T481 Version	$\Delta\lambda/\Delta T$	—	0.4	—	nm/°C
T483/T485 Versions	$\Delta\lambda/\Delta T$	—	0.1	—	nm/°C
Side-mode Suppression Ratio (T483/T485 Version) ³	SSR	30	—	—	dB
Extinction Ratio ⁴	r _e	8.2	—	—	dB
Eye Mask of Optical Output ^{5, 6}	—	Meets SONET and ITU-T			

1. Output power definitions and measurement per ITU-T Recommendation G.957 and G.958.
2. Full spectral width measured 20 dB down from the maximum of the central wavelength peak under fully modulated conditions.
3. Ratio of the average output power in the dominant longitudinal mode to the optical power in the most significant side mode under fully modulated conditions.
4. Ratio of logic 1 output power to logic 0 output under fully modulated conditions.
5. GR-253-CORE, *Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria*.
6. ITU-T Recommendation G.957, *Optical Interfaces for Equipment and Systems Relating to the Synchronous Digital Hierarchy*.

Outline Drawing

Dimensions are in inches and (millimeters).



1-999

Qualification and Reliability

To help ensure high product reliability and customer satisfaction, Lucent is committed to an intensive quality program that starts in the design phase and proceeds through the manufacturing process. Optoelectronics modules are qualified to Lucent internal standards using MIL-STD-883 test methods and procedures and using sampling techniques consistent with *Telcordia Technologies* requirements. This qualification program fully meets the intent of *Telcordia Technologies* reliability practices TR-NWT-000468 and TA-TSY-000983. In addition, the Lucent Technologies Microelectronics Group Optoelectronics design, development, and manufacturing facility has been certified to be in full compliance with the latest *ISO** 9001 Quality System Standards.

Laser Safety Information

Class I Laser Product

FDA/CDRH Class I laser product. All versions of the T48-Type transmitters are Class I laser products per CDRH, 21 CFR 1040 Laser Safety requirements. The transmitters have been certified with the FDA under accession number 8720009. All versions are Class I laser products per *IEC*† 60825-1:1993.

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

This product complies with 21 CFR 1040.10 and 1040.11.

8.8 μm /125 μm single-mode fiber pigtail with 914 μm tight-buffered outer jacket and connector

Wavelength = 1.3 μm , 1.5 μm

Maximum power = 1.6 mW

Because of size constraints, laser safety labeling is shipped with the device.
Product is not shipped with power supply.

Notice

Unterminated optical connectors can emit laser radiation.

Do not view with optical instruments.

* *ISO* is a registered trademark of The International Organization for Standardization.

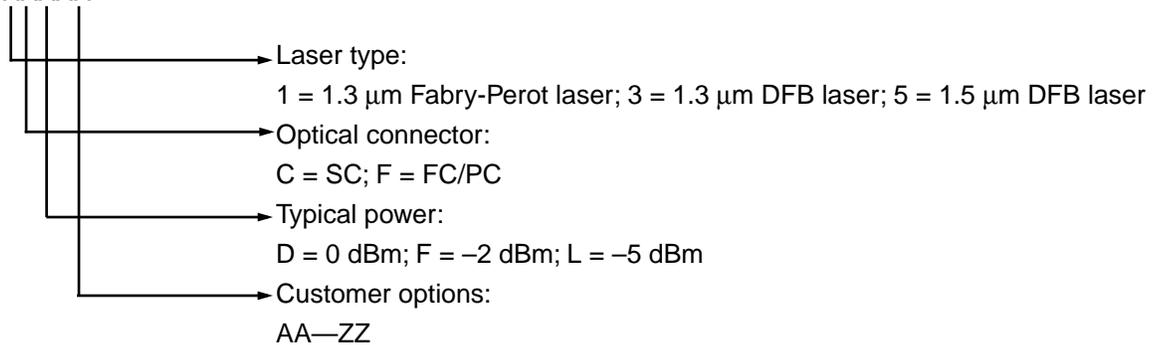
† *IEC* is a registered trademark of The International Electrotechnical Commission.

Ordering Information

Product Code	Connector	Comcode
T481CLAA	SC	108309162
T481FLAA	FC/PC	108309170
T483CDAA	SC	108309196
T483CFAA	SC	108309204
T483FDAA	FC/PC	108309212
T483FFAA	FC/PC	108309220
T485CDAA	SC	108400300
T485CFAA	SC	108400987
T485FDAA	FC/PC	108400995
T485FFAA	FC/PC	108401001

Coding Scheme

Example: T48XXXXX



Related Product Information

Product Code	Description	Document Number
1320-Type Lightwave Receiver	Lightwave Receiver with Clock Recovery and Data Retiming for 2488.32 Mbits/s Applications	DS97-113LWP
1320 2.5 Gbits/s Receiver	Biasing and Interfacing to the 1320 2.5 Gbits/s Receiver	AP98-052LWP
R485-Type Lightwave Receiver	Lightwave Receiver with Clock Recovery and Internal APD Bias Supply	—

For additional information, contact your Microelectronics Group Account Manager or the following:

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