Preliminary Data Sheet
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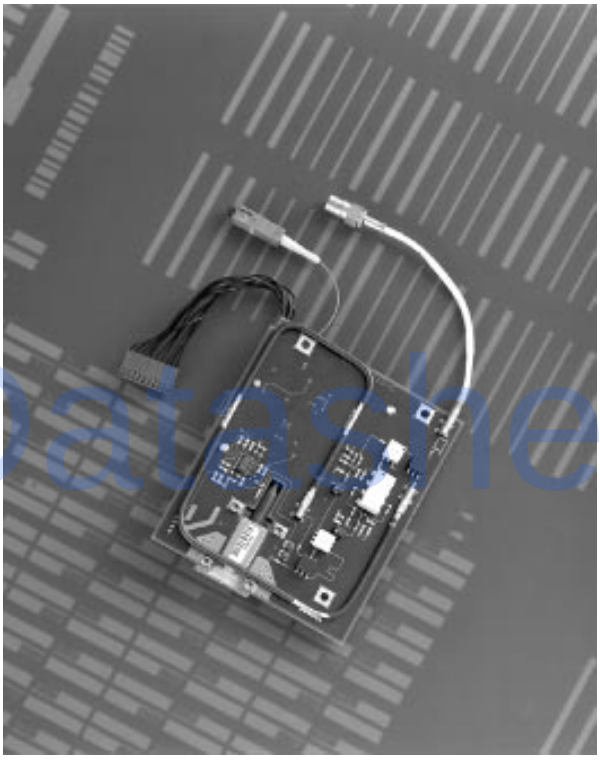
microelectronics group

Lucent Technologies
Bell Labs Innovations

A2300-Type Analog Integrated DFB Laser Module with Predistortion



The Integrated DFB Laser Module with Predistortion provides superior performance in analog transmission systems operating at 1310 nm wavelength.

Features

- High-performance, multiquantum-well (MQW), distributed-feedback (DFB), semiconductor laser.
- 14-pin, hermetic, butterfly-type package provides internal isolation and thermoelectric cooling/heating functions.
- Stable, accurate, PIN photodetector for laser back-facet optical output power monitoring/control.
- Operation at the low dispersion, 1310 nm wavelength.
- Stable performance over the wide temperature range of –20 °C to +65 °C.
- Multiple product options available:
  — 77/110 NTSC or 42 CENELEC test channel loading.
  — Simulated system testing available in a variety of fiber link budget losses.
- Superior signal quality and system performance compared to present coaxial-based analog systems.
- Only positive supply voltages required.
- Input return loss >16 dB.
- Wide, 1.5 dB bandwidth: 50 MHz—860 MHz.

Applications

- Video surveillance
- CATV
- Wireless/personal communications networks and systems

Description

The Lucent Technologies Microelectronics Group Optoelectronics unit is now offering a board-level solution for 1310 nm, cooled, internally isolated, directly modulated laser modules used in analog CATV optical transmitter applications. Expertise in the design and fabrication of analog laser modules for 1310 nm transmission, as well as in the design of predistortion circuits, allows Lucent to offer a broader range of performance in a highly competitive market.

The new offering features board-integrated functionality as a standard product, which reduces the time, resources, and expense typically required for individual component specifications, circuit designs, and manufacturing.

The A2300-Type Analog Integrated, DFB Laser Module contains a high-performance, Indium-Gallium-Arsenide-Phosphide, multiquantum-well, distributed-feedback laser chip designed for 1310 nm, single-mode fiber-optic applications. A 14-pin, butterfly-type, hermetic, metal/ceramic package houses the laser chip as well as an integral thermoelectric cooling/heating device, a thermistor, an integral optical isolator, and a laser back-facet optical monitor. The module is also equipped with a 900 μm *Hytrel** jacketed, 8.8 μm core, single-mode fiber.

The integral thermoelectric cooler (TEC) provides stable thermal characteristics for the laser chip, as well as the optical isolator and back-facet monitor. The TEC allows for heating and cooling of these internal optical components and can maintain their temperature at a constant 25 °C over the entire ambient operating temperature range of –20 °C to +65 °C. The thermistor monitors the internal module temperatures and provides feedback control for the TEC. This gives the A2300-Type Laser superior, stable optical characteristics.

When used in a fiber-optic system, reflected light entering the laser module is attenuated a minimum of 25 dB by the optical isolator. The internal PIN photodiode monitors the optical power emitted from the rear facet of the laser diode, and when used in conjunction with exterior module circuitry, it can monitor and control the optical output power launched into the fiber.

Lucent Technologies analog laser modules feature the capability to have enhanced performance and value through the addition of the Optoelectronics unit's exclusive predistortion circuit. The predistortion circuit provides both CSO and CTB correction enhancements to the laser module performance, for 110 NTSC as well as 42 CENELEC channels. While maintaining extremely low electrical power dissipation and low insertion loss, the predistortion circuit allows 860 MHz of RF bandwidth.

Every A2300-type module is tested to meet the customer's analog performance specifications, over the specified fiber link budget loss and test channel plan. This measurement method ensures proper system performance of the product. Lucent Technologies Optoelectronics unit components and products are qualified to the rigorous requirements of Bellcore standards, ensuring that the optoelectronic performance will meet the needs of the application over the lifetime of the product.

* *Hytrel* is a registered trademark of E.I. DuPont de Nemours and Company.

Handling Precautions

The minimum fiber bend radius is 1.25 in. To avoid degradation in performance, mount the module board as follows:

Place the module on a flat heat sink surface. The surface finish should be better than 32 µin. (0.8 µm), and the surface flatness must be better than 0.001 in. (25.4 µm). The use of thermal conductive grease is optional; however, thermal performance can be improved if conductive grease is applied between the heat sink surfaces.

Power Sequencing

Adopt the following sequence for turn-on as a matter of good practice to avoid the possibility of damage to the laser module from power supply switching transients.

1. All ground connections.
2. Most negative supply.
3. Most positive supply.
4. All remaining connections.

Reverse the above order for the proper turn-off sequence.

Electrostatic Discharge

CAUTION: This device is susceptible to damage as a result of electrostatic discharge. Take proper precautions during both handling and testing. Follow guidelines such as JEDEC Publication No. 108-A (Dec. 1988).

Lucent 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 threshold presented here was obtained using these circuit parameters:

Parameter	Value	Unit
Human-body Model	400	V

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
Laser Reverse Voltage	—	—	2	V
Laser dc Forward Current	—	—	150	mA
Module Board dc Supply Voltage	—	11.9	12.1	V
RF Modulation per Channel (75 Ω)	—	—	0	dBm
Operating Temperature Range	T_A	–20	65	°C
Storage Case Temperature Range	T_{stg}	–40	85*	°C

* 2000 hours maximum.

Characteristics

Minimum and maximum values are testing requirements. Typical values are for informational purposes only and are not part of the testing requirements. Each device is provided with recommended operating conditions to achieve specified performance. T_L = 25 °C, unless noted otherwise. Module board supply voltage is +12 Vdc.

Table 1. Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Laser Forward Voltage	V_{LF}	At rated power	—	1.3	1.8	V
Laser Operating Current	I_{OP}	—	—	50	100	mA
Threshold Current	I_{TC}	*	—	10	40	mA
Monitor Reverse-bias Voltage	V_{MON}	—	3	—	10	V
Monitor Current	I_{MON}	At I_{OP}	0.2	—	2.0	mA
Monitor Dark Current	I_D	I_F = 0, V_{MON} = 5 V	—	—	0.10	µA
Thermistor Current	I_{TH}	—	10	—	100	µA
Thermistor Resistance	R_{TH}	T_L = 25 °C, $I_{TH} \leq$ 0.1 mA	9.5	—	10.5	kΩ
Thermistor Thermal Characteristic	$\Delta R_{TH}/\Delta T_L$	–20 °C ≤ T_L ≤ 65 °C†	—	–4.4	—	%/°C
Thermistor Temperature Coefficient	B	—	3700	3900	4100	K
TEC Current	I_{TEC}	ΔT = 40 °C	—	—	1.0	A
TEC Voltage	V_{TEC}	ΔT = 40 °C	—	—	1.8	V
TEC Cooling Capacity	ΔT	—	40	—	—	°C

* The laser threshold current is the current at which the first derivative of the laser light vs. forward current is at one-half of its maximum.
† The thermistor thermal characteristic will be monotonic.

Table 2. Optical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Optical Output Power	P_O	—	3.0	—	20.0	mW
Center Wavelength	λ_C	—	1290	1310	1330	nm
Optical Isolation	—	–20 °C to +65 °C	25	—	—	dB
Side-mode Suppression Ratio	SMSR	Modulated	30	—	—	dB

Pin Function Information

The electrical connector is a 10-pin type *Molex** Part No. 22-01-310. The RF connector is a 75 Ω female, SMB-type.

Table 3. Pin Descriptions

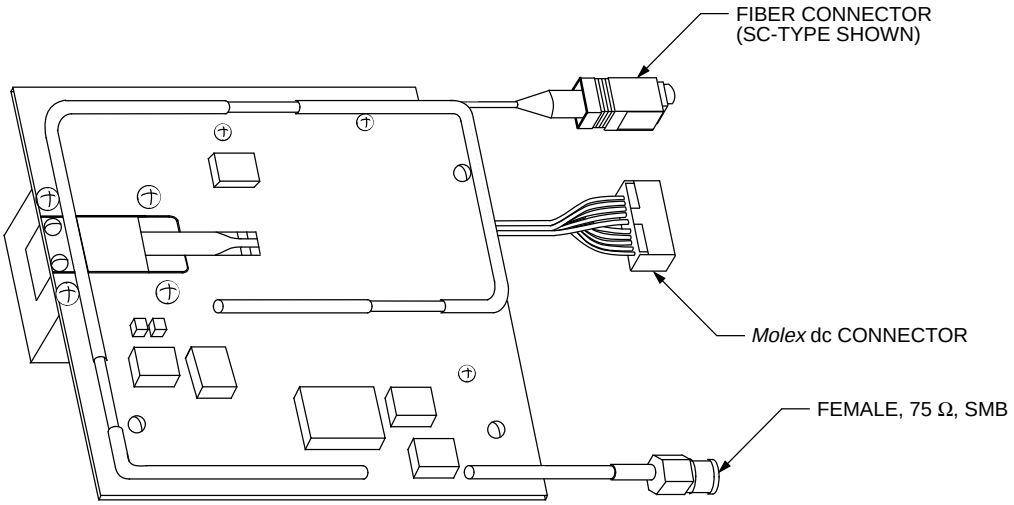
Pin Number	Connection	Function
1	Monitor-Photodiode Cathode	+5 Vdc, 5 mA max.
2	Reference Ground	Photodiode anode GND.
3	TE Cooler (+)	Current into pin cools; 1.2 Adc max.
4	TE Cooler (–)	Current into pin heats; 1.2 Adc max.
5	Thermistor	10 kΩ ± 2% @ 25 °C. T_C of –4.4% per °C, Type B.
6	Laser Bias	Laser requires a sink current into this pin, 100 mAdc max.
7	dc Circuit Bias	+12 Vdc ± 5%; 225 mAdc max.; 100 mV_{P-P} max. ripple.
8	No Connection	NA
9	Power Ground	GND return.
10†	No Connection	NA

* *Molex* is a registered trademark of Molex, Inc.
† Pin 10 is marked on connector; connector type is unidirectional.

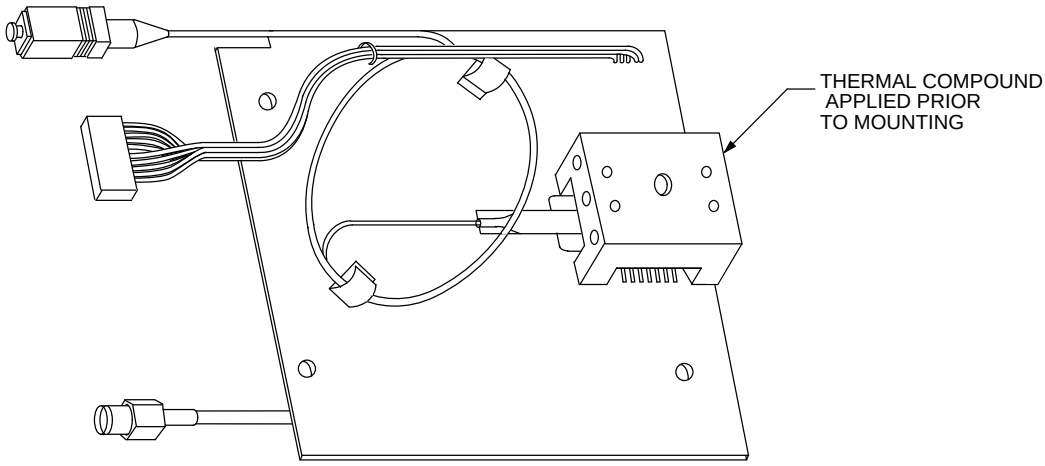
Outline Diagrams

Dimensions are in inches.

Transmitter Assembly Board



TOP VIEW



BOTTOM VIEW

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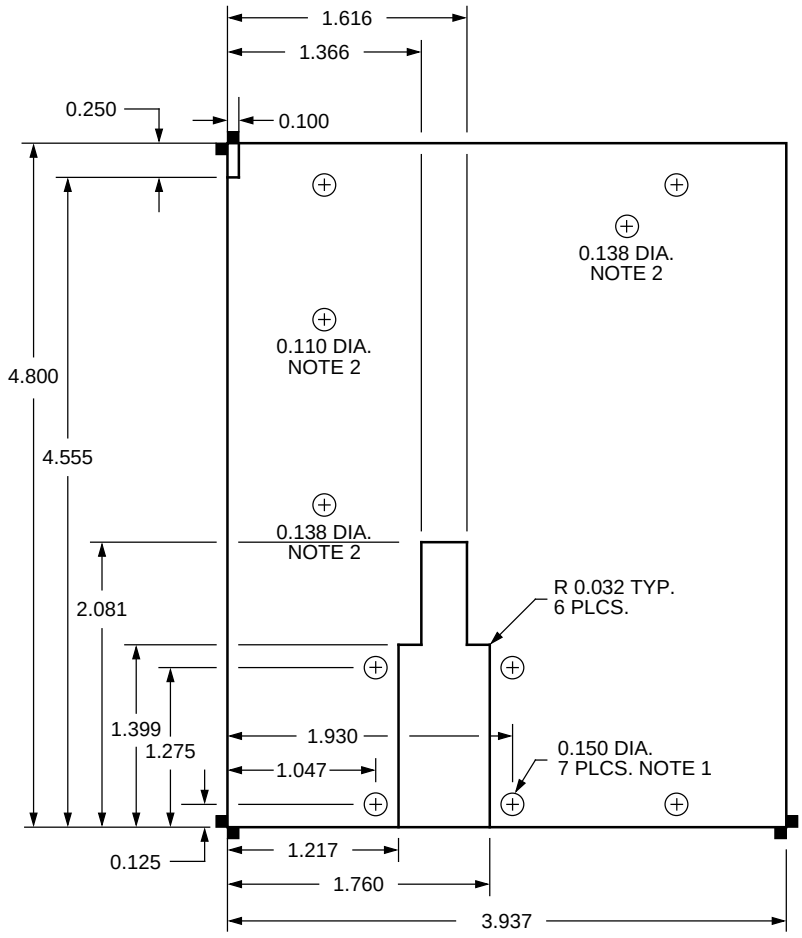
Outline Diagrams (continued)

Dimensions are in inches.

Transmitter Assembly Board Dimensions, Top View



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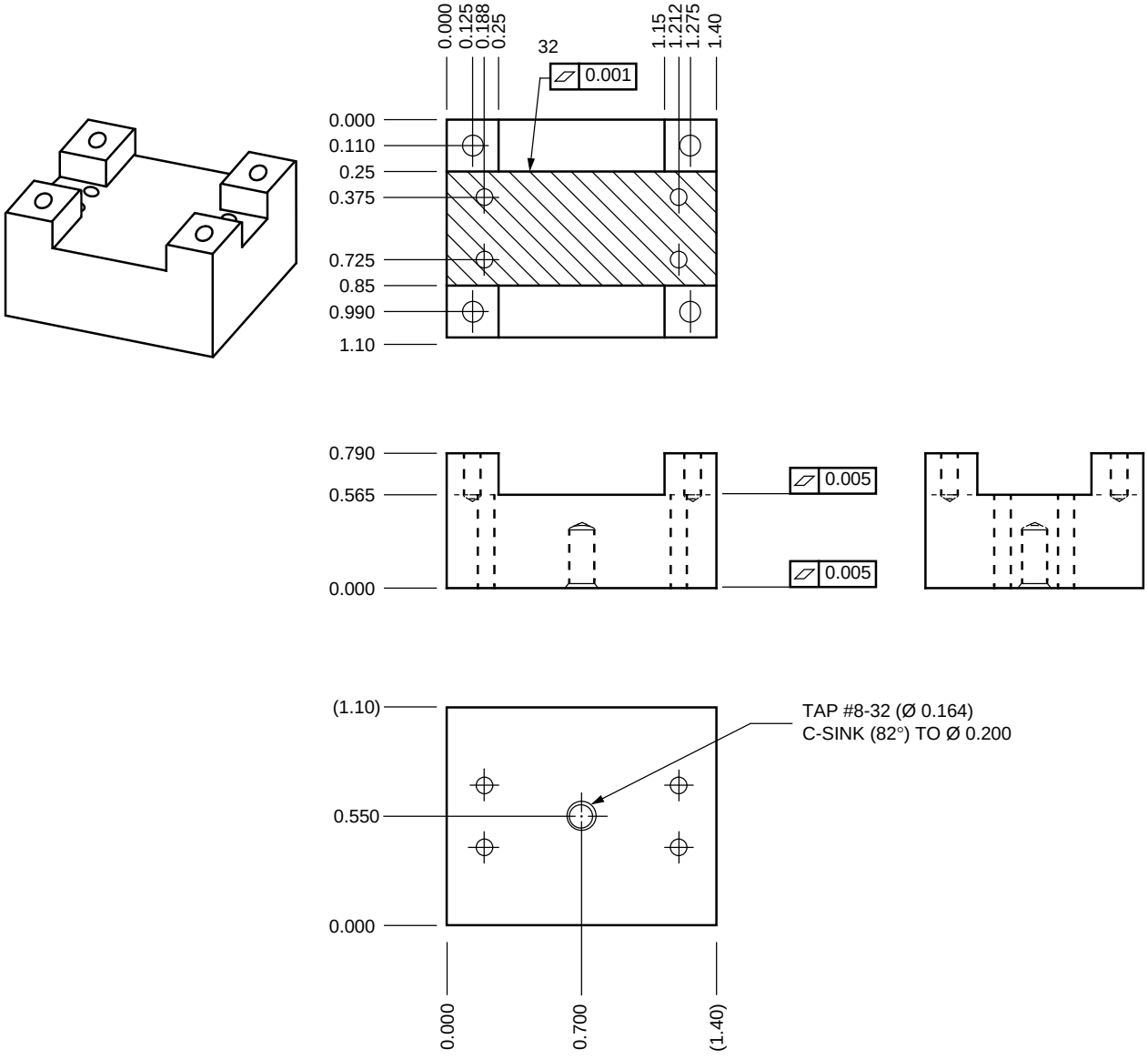
1. Plated heat sink mounting holes.
2. Unplated board mounting holes.

Outline Diagrams (continued)

Dimensions are in inches.

Laser Assembly Heat Sink



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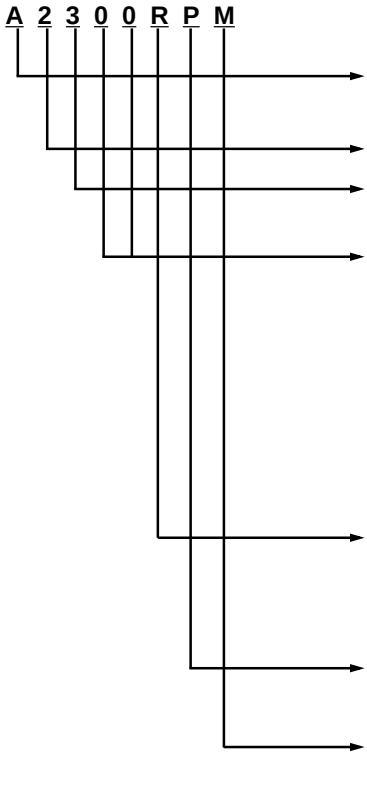
Part Numbering for the A2300-Type Laser



Field Description

Alpha character indicating product type
A = Analog

2 = Laser 2000

Wavelength indicator
3 = 1.3 μm typical devices

Link loss series and power range
00 → 5 dB link loss (00 through 09)
10 → 7 dB link loss (10 through 19)
20 → 9 dB link loss (20 through 29)
30 → 9 dB link loss; high power (30 through 39)
40 → 11 dB link loss (40 through 49)
50 → 11 dB link loss; high power (50 through 59)
60 → 13 dB link loss (60 through 69)
70 → 13 dB link loss; high power (70 through 79)

Alpha character indicating standard connector options
B = SC-APC; 2.15 m ± 0.2 m
R = FC-APC; 2.15 m ± 0.2 m
D = SC-PC; 2.15 m ± 0.2 m

Package type
P = Predistorted laser

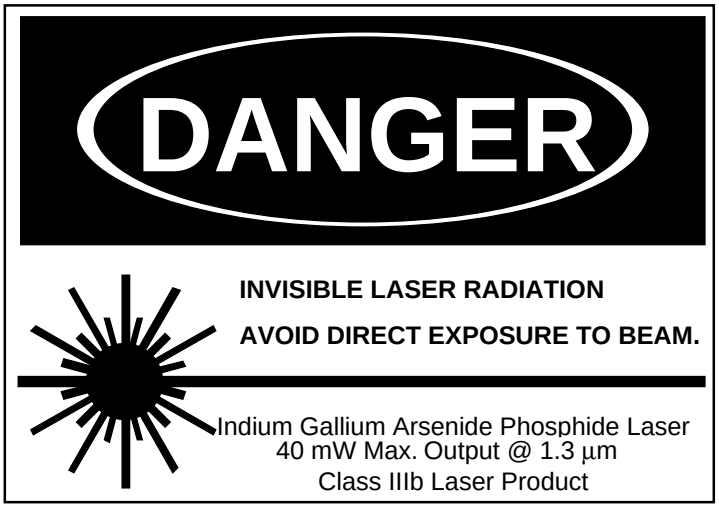
Product configuration
M = Integrated module board

Laser Safety Information

Class IIIb Laser Product

This product complies with 21 CFR 1040.10 and 1040.11.
Single-mode connector
Wavelength = 1.3 µm
Maximum power = 40 mW
Because of size constraints, laser safety labeling is not affixed to the module but is contained on 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.



DANGER
INVISIBLE RADIATION IS EMITTED FROM THE END OF THE FIBER OR CONNECTOR. AVOID DIRECT EXPOSURE TO THE BEAM. DO NOT VIEW WITH OPTICAL INSTRUMENTS.

Ordering Information

Table 4. Analog Product Availability, Integrated Laser/Predistorter

L2000 Part Number	Comcode	Tested Loss*	Optical Power	Channel Capacity	CNR (dBc)	CSO (dBc)	CTB (dBc)
A2317DPM	108239294	7 dB	6 dBm—8 dBm	77 NTSC	52	–63	–68
A2318DPM	108239302	7 dB	6 dBm—8 dBm	110 NTSC	50	–63	–68
A2319DPM	108239310	7 dB	6 dBm—8 dBm	42 CENELEC	52	–63	–67
A2356DPM	108239328	11 dB	10 dBm—12 dBm	77 NTSC	52	–63	–68
A2359DPM	108239336	11 dB	10 dBm—12 dBm	110 NTSC	50	–63	–68
A2355BPM	108116641	11 dB	>11 dBm	42 CENELEC	52	–63	–67
A2377DPM	108239344	13 dB	>10 dBm	77 NTSC	52	–63	–68
A2378DPM	108239351	13 dB	>10 dBm	110 NTSC	51	–63	–68
A2358BPM	108116674	13 dB	>12 dBm	42 CENELEC	53	–63	–67

* 7 dB is all fiber; NTSC: 11 dB and 13 dB include a minimum 9 dB of fiber loss; CENELEC: 11 dB and 13 dB include a minimum 7 dB of fiber loss.

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

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