Advance Data Sheet
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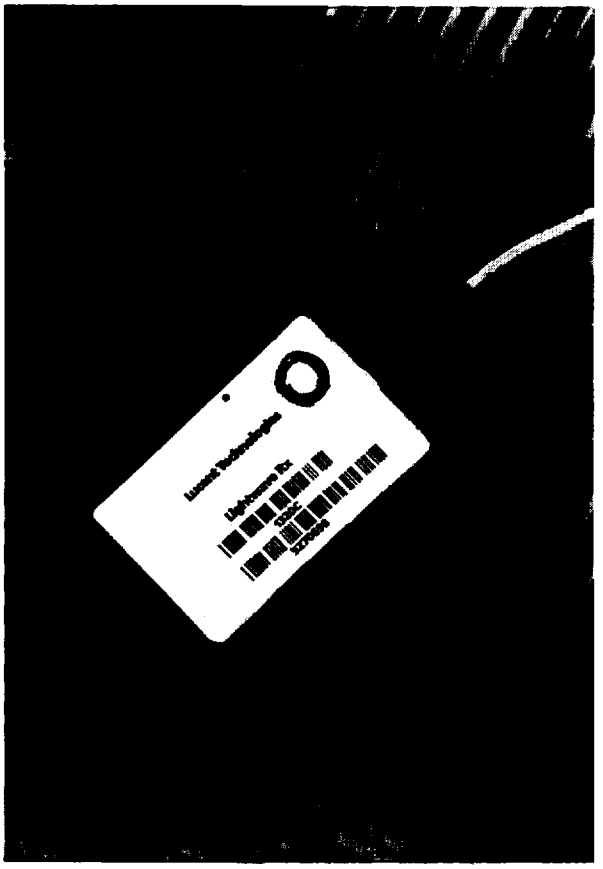
microelectronics group

Lucent Technologies
Bell Labs Innovations

1320-Type *ASTROTEC*® Lightwave Receiver



The 1320-Type *ASTROTEC* Lightwave Receiver is manufactured in a 24-pin DIP with a multimode fiber pigtail.

Features

- Wide dynamic range
- SONET-compatible for OC-12/STM-4 data rate
- Space-saving, self-contained, 24-pin DIP
- Lucent Technologies' Reliability and Qualification Program for built-in quality
- Operation at 1.3 µm or 1.55 µm wavelengths
- Positive ECL-level outputs
- Link-status flag
- Regenerated differential clock signal
- Operating case temperature range: –40 °C to +85 °C
- Clocked decision circuit

Applications

- Telecommunications
  - — Inter- and intraoffice SONET/ITU-T SDH
  - — Subscriber loop
  - — Metropolitan area networks
- High-speed data communications

Description

The 1320-Type *ASTROTEC* Lightwave Receiver is designed for use in transmission systems or medium- to high-speed data communication applications. Used in intraoffice and intermediate-reach applications, the receiver operates at the SONET OC-12 data rate as well as the ITU-T (formerly CCITT) Synchronous Digital Hierarchy (SDH) rate of STM-4.

The device meets all present Bellcore TA-TSY-000253 requirements, the current ANSI T1X1.5 intraoffice specification, and the ITU-T G.957 and G.958 recommendations. Compact packaging, a high level of integration, and a wide dynamic range make the receiver ideal for data communication.

Manufactured in a 24-pin DIP, the receiver consists of a planar, InGaAs PIN photodetector, a GaAs preamplifier, a silicon bipolar limiting amplifier that converts the small signal to ECL levels, a timing recovery unit to recover the clock, and a silicon bipolar decision circuit.

The receiver converts optical signals in the range of 1.2 µm to 1.6 µm into retimed clock and data signals. The clock and data outputs are raised-ECL (PECL) logic waves. A CMOS-level flag output indicates when there is a loss of optical signal. When the flag is asserted (loss of optical input), the data and clock outputs are squelched.

The receiver requires a +5 V power supply for the amplifier, logic, and SAW CRC circuits. The operating case temperature range is –40 °C to +85 °C.

Flag Output

When the optical input signal falls below the link-status threshold level, the FLAG signal is asserted and its output logic-level changes from a CMOS logic-low to a CMOS logic-high. At the same time, the data and clock outputs are squelched. The DATA and CLOCK outputs switch to a PECL logic-low and the $\overline{\text{DATA}}$ and $\overline{\text{CLOCK}}$ outputs switch to a PECL logic high.

Pin Information

Pin	Name	Pin	Name
1	No User Connection*	13	Ground
2	No User Connection*	14	Ground
3	FLAG†	15	Ground
4	Ground	16	Ground
5	$\overline{\text{CLOCK}}$	17	Ground
6	CLOCK	18	No User Connection*
7	Ground	19	Ground
8	Ground	20	Ground
9	Ground	21	No User Connection*
10	DATA	22	Vcc
11	$\overline{\text{DATA}}$	23	No User Connection*
12	Vcc	24	No User Connection*

* Pins designated as No User Connection are connected internally. However, to allow for future functional upgrades, it is recommended that the user not make any connections to these pins.

† The link status flag is a logic flag that indicates the presence or absence of a minimum acceptable level of optical input. A logic high on the FLAG output indicates the absence of a signal.

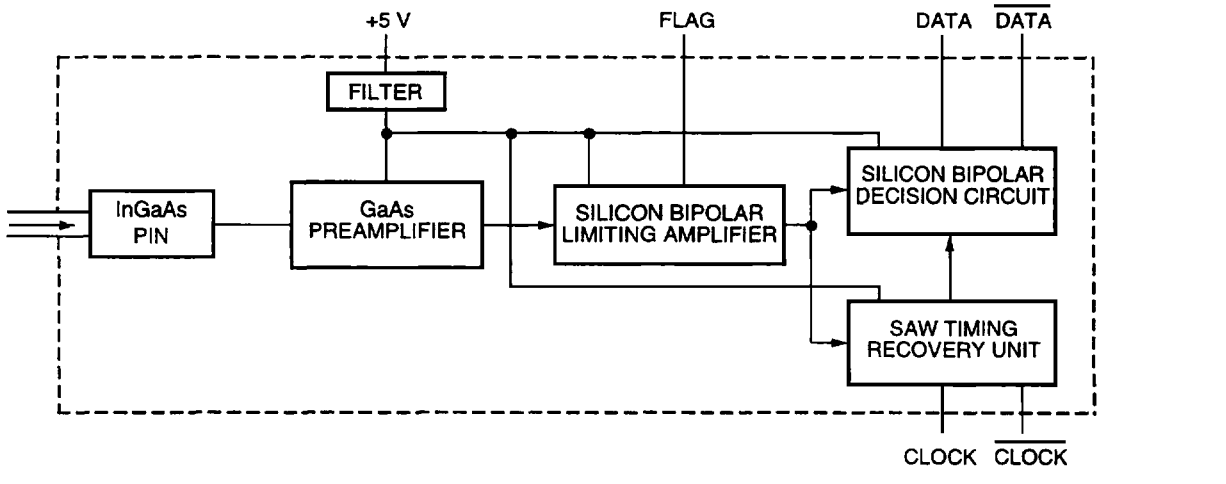


Figure 1. Block Diagram

Handling Precautions

The 1320 receiver has a 39 in. ± 4 in. (100 cm ± 10 cm) 62.5 µm core multimode fiber pigtail. The 1320C is manufactured with a 0.036 in. (914 µm) diameter fiber pigtail and an ultra polished FC-PC optical connector. The 1320D is manufactured with a 0.09 in. (2.4 mm) diameter pigtail having an SC optical connector. Other optical connector options are available on special order. Please contact a Lucent Technologies Microelectronics Group Account Manager for availability and ordering information.

The minimum fiber bending radius is 1.5 in.

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

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

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.

Receiver Processing

The 1320-Type Receiver devices can withstand normal wave-soldering processes. The complete receiver module is not hermetically sealed; therefore, it should not be immersed in or sprayed with any solutions. The process cap deformation temperature is 85 °C. The receiver pins can be wave-soldered at 250 °C for 10 seconds.

Installation Considerations

Although the receiver 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).

The 1320-Type Receiver has been subjected to a fiber pull mechanical strength test as part of device qualification (see Qualification Testing section). However, the cable should be handled conservatively with no excessive axial pulling or lateral tugging.

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	T_C	–40	85	°C
Storage Temperature	T_{stg}	–40	85	°C
Operating Wavelength Range	λ	1.2	1.6	µm
Supply Voltages	V_{CC} V_{PIN}	0 0	5.5 –15	V V
Lead Soldering Temperature/Time	—	—	250/10	°C/s

Characteristics

Table 1. Electrical Characteristics

Parameter	Symbol	Min	Typ*	Max	Unit
Bit Rates	—	622.018	622.080	622.142	Mbits/s
dc Power Supply Voltages	V_{CC}	4.75	5.0	5.25	V
dc Power Supply Current Drains	I_{CC}	—	215	300	mA
Data/Clock Output Rise and Fall Time	t_R/t_F	—	330	600	ps
Output Data/Clock Voltage:†**					
Low	V_{OL}	V_{CC} – 1.95	—	V_{CC} – 1.63	V
High	V_{OH}	V_{CC} – 1.03	—	V_{CC} – 0.88	V
Output Flag Voltage:†**					
Low	V_{OL}	0	—	0.5	V
High	V_{OH}	V_{CC} – 0.5	—	V_{CC}	V
Clock/Data Alignment‡	T_{CDA}	–200	—	200	ps
Clock Duty Cycle	—	45	—	55	%
Output Clock Random Jitter§	Jc				
622 Mbits/s		—	10	16	ps rms

* Typical values are measured at room temperature.
† Measured with 50 Ω load with the configuration shown in Figure 3.
‡ Measured as shown in Figure 2.
§ Measured with an input data pseudorandom word $2^{23} - 1$.
** See Flag Output section on page 2 for output levels when flag is asserted.

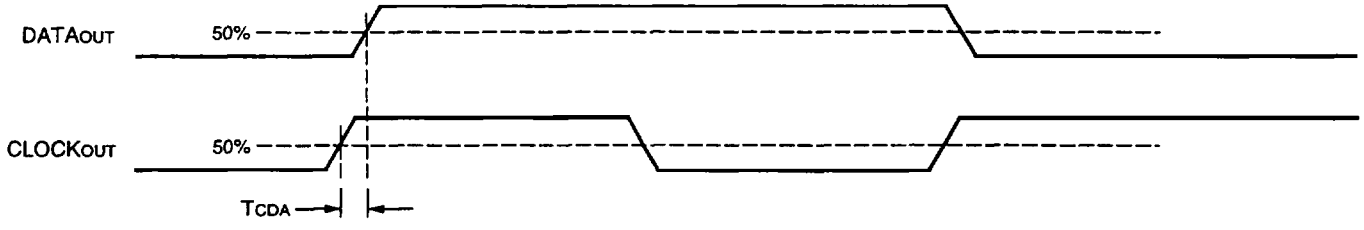


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Figure 2. Clock/Data Alignment

Characteristics (continued)

Table 2. Optical Characteristics

Rated for 1.3 μm wavelength operation at 10^{-10} BER.

Parameter	Bit Rate (Mbits/s)	Symbol	Min*	Typ†	Max*	Unit
Measured Average Sensitivity‡§	622	P_{RL}	–28.0	–31.5	–33	dBm
Maximum Input Power‡	622	P_{RH}	–6	–45	—	dBm
Link Status Flag Threshold:						
Decreasing Light Input	622	LST_D	—	–33.5	—	dBm
Increasing Light Input	622	LST_I	—	–31.5	—	dBm
Flag Response Time**	—	t_{FLAG}	3	—	100	μs

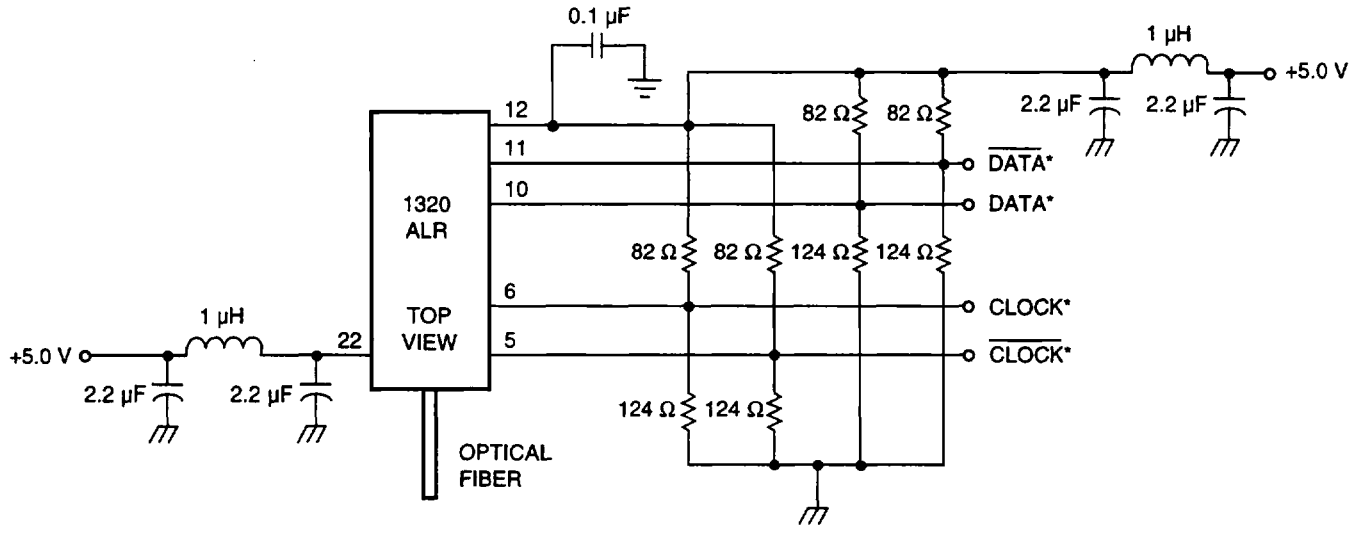
* Over operating temperature range and at end of life (EOL).
† Typical values at room temperature and beginning of life (BOL).
‡ For a 1E-10 BER. Measured with a $2^{23} - 1$ pseudorandom word optical input having a 50% average duty cycle.
§ Power supply noise in excess of 50 mV peak-to-peak may degrade the performance of the receiver. See User Interface section for recommended power supply filtering.
** Whenever the flag output is asserted (logic high), the DATA and CLOCK outputs are squelched. See the Flag Output section on page 2 for the DATA and CLOCK output signal levels when flag is asserted.

PWB Layout Guidelines

- Follow high-speed ECL design rules.
- All high-speed output lines must be controlled-impedance lines, and the termination impedance must match the line impedance. Controlled-impedance interruptions should be avoided (i.e., 90° bends, etc.), and paired lines (i.e., DATA and $\overline{\text{DATA}}$) should be of equal length.
- Each output line should be terminated at the end of the line and must have a bypass capacitor on the voltage side of the resistor for each termination.
- Data and clock output lines should be as short and as straight as possible and isolated from noise sources (and each other) to prevent noise from feeding back into the receiver.
- Noise that couples into the receiver through the power supply pins can degrade device performance. See Figure 3 for an example of power supply filtering for the receiver +5 V power supply pins.
- Use a multilayer board so that the ground plane surrounds the areas occupied by the receiver and directly underneath it. Directly attach all pins listed as ground pins to the ground plane with no additional lead length.

All unused outputs must be terminated as shown. All resistors are 1/8 W, thin-film, ceramic chips. All capacitors are 25 Vdc, ceramic X7R or equivalent.

Recommended User Interfaces



* DATA, $\overline{\text{DATA}}$, CLOCK, and $\overline{\text{CLOCK}}$ are 50 Ω transmission lines that can be ac- or dc-coupled.

Figure 3. PECL Compatible (+5 V) Interface

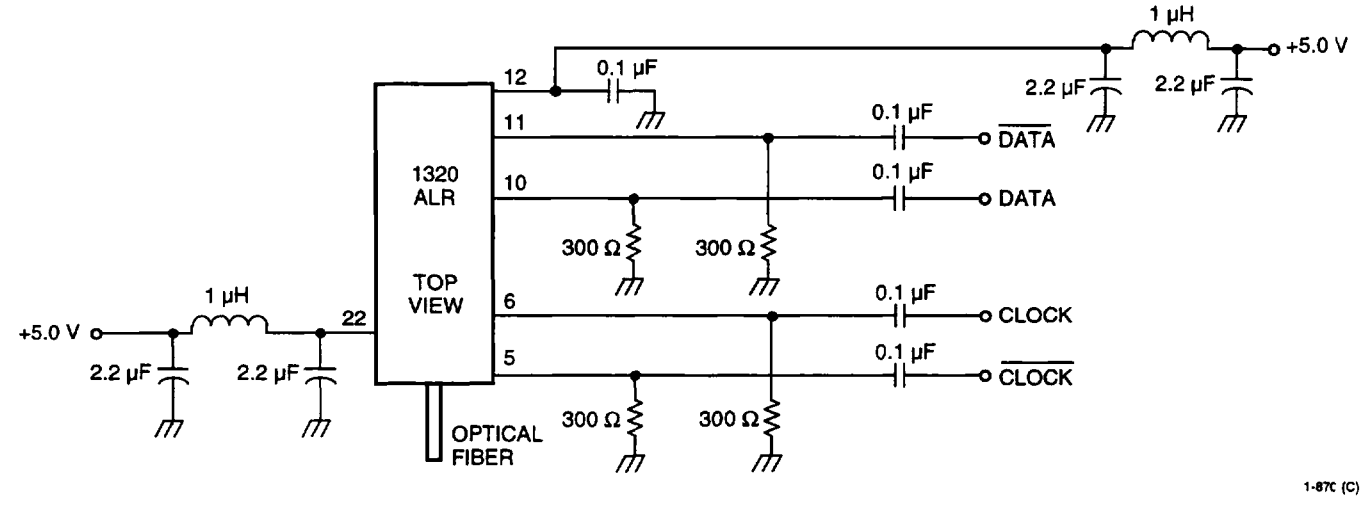


Figure 4. ac-Coupled ECL-Compatible Interface

Qualification Testing

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 and shipping processes. Optoelectronic modules are qualified to Lucent internal standards using MIL-STD-883 test methods and procedures and sampling techniques consistent with Bellcore requirements. The receiver will meet the specifications of Bellcore TR-NWT-000468 and TA-TSY-000983.

The 1320-Type Receiver has been subjected to the following qualifications and meets the specifications of Bellcore TR-NWT-000468 and TA-TSY-000983.

Test	Conditions	Sample Size	Failure Criteria
Physical Dimensions	MIL-STD-883C-2016	90	Visual
External Visual	MIL-STD-883C-2009.8	90	Visual
Impact Shock	1500G, 5 hits, 6 dir., MIL-STD-883C-2002, Condition B	11	Electrical/optical
Variable Frequency Vibration	20G, 20 Hz to 2 kHz, 4 cycles, 3 directions, 4 min./cycle, MIL-STD-883C-2007.1	11	Electrical/optical
Solderability	MIL-STD-883C-2003.6	5	Visual
Lead Integrity	MIL-STD-883C-2004.5	5	Visual
Solvent Resistance	MIL-STD-883C-2015.7	5	Visual
Temperature Cycle	–40 °C to +85 °C, 500 cycles, MIL-STD-883C-1010.7	11	Electrical/optical
High Temperature, High Humidity, with Bias	85 °C, 85% relative humidity, rated bias, 2000 hours	11	Electrical/optical
High Temperature with Bias	85 °C ambient, rated bias, 5000 hours, MIL-STD-883C-1005.5	11	Electrical/optical
Internal Visual	MIL-STD-883C-2014	10	Visual
Electrostatic Discharge	Human-body model (to determine class)	5	Electrical/optical
Fiber Pull	1 kg	11	Electrical/optical
Low-temperature Storage	–40 °C, 2000 hours	11	Electrical/optical
Voltage Stress	Maximum rated voltage	10	Electrical/optical
Power Cycling	MIL-STD-1006	5	Electrical/optical
Flammability	Fiber cable meets *UL**-listed OFN	—	—

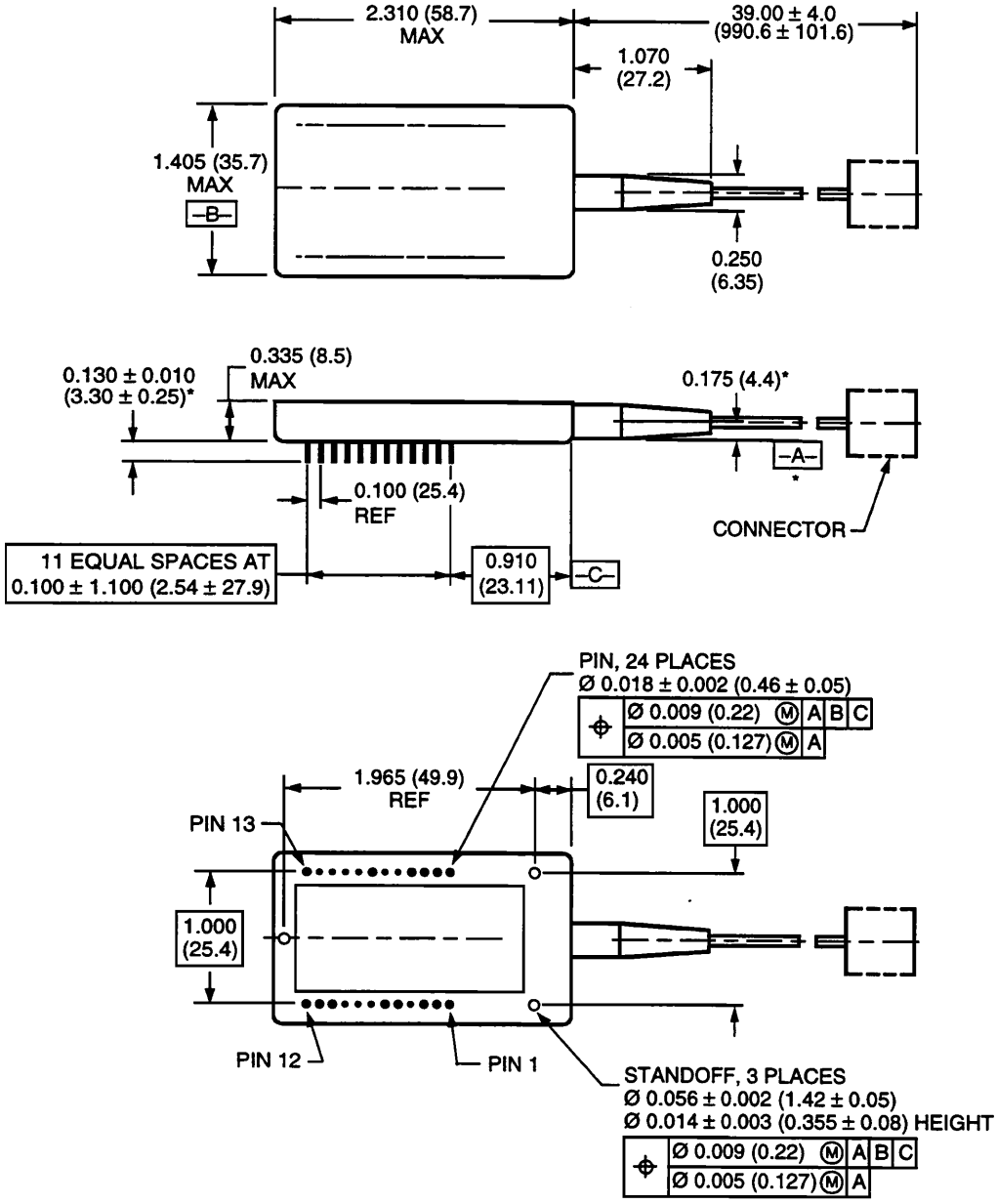
* *UL* is a registered trademark of Underwriters Laboratories, Inc.

Outline Diagram

Dimensions are in inches and (millimeters).

Tolerances are ±0.005 in. (±0.127 mm).

Weight = 2.5 oz. (70.87 g)



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* Reference surface is to bottom of housing, not to bottom of standoffs.

Notes: Handling precautions — handle electrostatic sensitive devices in accordance with recognized ESD-handling procedures.

Code	Connector	Bit Rate (Mbits/s)
1320C	FC-PC	622
1320D	SC	622

Ordering Information

Table 3. 1320-Type Receiver Ordering Information

Product Code	Data Rate (Mbits/s)	Connector	Lucent Comcode
1320C	622	FC-PC	107142218
1320D	622	SC	107142226

Table 4. Related Product Information

Product Code	Description	Document Number
1227-Type	1227-Type *ASTROTEC* Transmitter	DS95-104LWP
1310-Type	1310-Type *ASTROTEC* Receiver for OC-1/STM-1, 3	DS94-160LWP
	1310-Type *ASTROTEC* Receiver for OC-12/STM-4	DS94-159LWP
1330-Type	Receiver with Clock Recovery for OC-3/STM-1, OC-12/STM-4	DS95-192LWP

Table 5. Related Literature

Description	Document Number
Cleaning Fiber-Optic Assemblies	TN95-010LWP

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

OPTOELECTRONICS BUSINESS UNIT: Optoelectronics Center, 9999 Hamilton Blvd., Breinigsville, PA 18031-9359
610-391-2520, FAX 610-391-2535

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