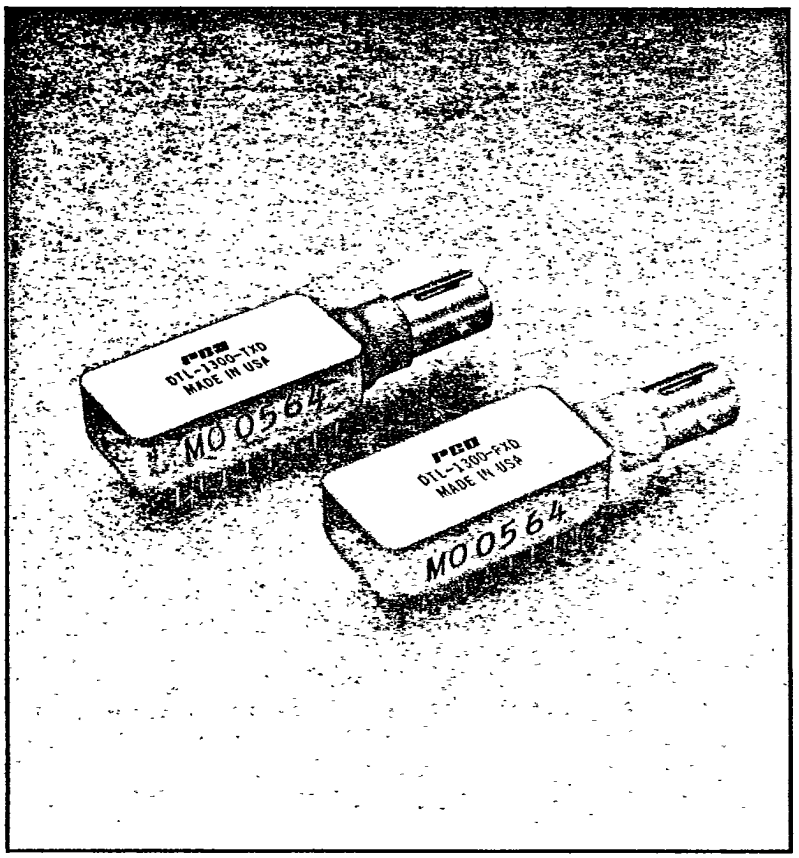
Digital Data Link

Preliminary

DTL-1300 SERIES: "D" Version
1300 nm Transmitter/Receiver Modules

T-41-91



Features

- Long Wavelength — 1320 nm Operation
- High Speed — 1 to 270 Mb/s
- Long Distance — up to 1 km at 270 Mb/s
- 13 to 17 dB Link Budget
- Small 16 Pin Hermetic Metal Packages
- Wide Temperature Range — -40°C to +70°C
- Standard Logic Interface — 10 K and 100 K ECL Compatible

Description

The DTL-1300D Digital Transmission Links are high performance modules (transmitter/receiver) designed for use with multimode fiber links. Data rates from 1 to 270 Mb/s and distances of 1 kilometer or more can be supported. The extended operating temperature range and receiver sensitivity of these data links make them useful in rugged environments as well as in typical computer and data communications applications.

Though a commercial product, the DTL-1300D integrated circuit design and high reliability packaging make it suitable for use in some military applications as well.

All electronic and optical functions are contained within the standard low profile PC-board mountable 16 pin hermetic dual-in-line (DIP) package transmitter and receiver modules. The modules incorporate custom bipolar integrated circuits and ST™ compatible receptacles for ease of handling and connection.

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Transmitter Performance Characteristics

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Type D Transmitter (T_a = +25°C) (270 Mb/s)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Electrical Interface					
Supply Voltage [1]	V_{EE}	-5.7	-5.2	-4.7	V
Supply Current	I_{EE}	-	90	130	mA
Power Dissipation	P	-	470	750	mW
Optical Interface					
Optical Output Power [2,3]	$\overline{P}_o$	-19.0	-17.0	-	dBm
Rise/Fall Time [4]	$t_r t_f$	-	2.0	2.3	ns
Data Rate	B	DC	-	270	Mb/s
ON:OFF Ratio	-	20:1	-	-	-
Output Power Temperature Coefficient [5]	-	-	-0.7	-1.0	%/°C
Center Wavelength [6]	λ_c	1280	1320	1355	nm
Temperature Coefficient of λ_c	-	-	+0.3	-	nm/°C
Spectral Width (FWHM) [6]	$\Delta\lambda$	-	150	-	nm
Temperature Coefficient of $\Delta\lambda$	-	-	+0.4	-	nm/°C

Notes:
1. Can also operate on a DC +5 V power supply. Tolerance is ±5%.
2. Average coupled power into 62.5/125 micron graded index fiber.
3. Approximately 5 dB less power coupled into 50/125 micron graded index fiber; approximately 2 dB more power coupled into 85/125 micron fiber.
4. Measured from 10-90% points.
5. At -40°C, the average optical output power is approximately 2 dB above that at 25°C. At 70°C the average optical output power is approximately 2 dB below that at 25°C.
6. Measured with 50% duty cycle drive signal.

Transmitter Signal Interface

Parameter	Symbol	Minimum	Maximum	Units
Input HIGH Voltage	V_{IHS}	V_{CC} -1.165	V_{CC} -0.88	V
Input LOW Voltage	V_{ILS}	V_{CC} -1.81	V_{CC} -1.475	V
Differential Input Voltage	V_{DIF}	0.3	1.1	V
Input Common Mode Range [1]	V_{ICM}	-	1.0	V

[1] Permissible ±V_{ICM} with respect to V_{BB}.

Transmitter Operation

The transmitter behaves logically as a differential input gate which controls a 1300 nanometer light emitting diode. When the DATA input voltage is greater than the $\overline{DATA}$ input voltage, the LED is ON. When the $\overline{DATA}$ signal is greater than the DATA input voltage, the LED is OFF. When used in a single-ended application, the unused input pin should be biased to V_{BB} (V_{CC} -1.32 volts).

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Receiver Performance Characteristics

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Type D Receiver (T_a = +25°C) (270 Mb/s)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Electrical Interface					
Supply Voltage [1]	V_{EE}	-5.7	-5.2	-4.7	V
Supply Current [1, 2]	I_{EE}	-	60	80	mA
Power Dissipation	P	-	250	450	mW
Optical Interface					
Data Rate	B	1	-	270	Mb/s
Sensitivity (10^{-12} BER) [3]	$\overline{P}_{IN}$	-32	-34	-	dBm
Max Operating Optical Input Power	$\overline{P}_{MAX}$	-18	-16	-	dBm
Temperature Derating (-40°C to +70°C) [4]		-1	0	+1	dBm
Wavelength of Operation	λ	1100	1320	1600	nm
Carrier Detection Level [5]	$\overline{P}_{CD}$	-40	-36	-35	dBm

Notes:
1. Can also operate on a DC +5 V power supply. Tolerance is ±5%.
2. Measured with open circuited outputs.
3. Average incident power for all fiber sizes up to 85/125 micron measured at the input connector with balanced code optical input with 2.5 ns rise/fall time.
4. Measured under conditions of maximum data rate 50% duty cycle input signal over temperature range of -40°C to +70°C. Minimum average sensitivity over temperature range is -31 dBm.
5. Carrier detection output threshold is an ECL level signal which switches from high to low level when the average input optical signal is below this nominal power level.

Receiver Signal Interface

Parameter	Symbol	Minimum	Maximum	Units
Output HIGH Voltage	V_{OH}	V_{CC} -1.025	V_{CC} -0.88	V
Output LOW Voltage	V_{OL}	V_{CC} -1.81	V_{CC} -1.62	V

Receiver Operation

The receiver converts optical energy to a photocurrent using a high performance PIN diode. The photocurrent is converted to a proportional analog voltage by a transimpedance amplifier. This low level analog signal is amplified by additional gain stages and processed through a shaping filter and a comparator to generate the differential emitter coupled logic (ECL) output signals. Both outputs (DATA and $\overline{DATA}$) are open emitters requiring termination to V_{CC} -2 volts with 50 ohms or to V_{EE} with 510 ohms.

The threshold detection circuit monitors the level of the incoming optical signal and outputs a logic LOW signal when insufficient photocurrent is produced. The threshold signal can be used to control an external squelch circuit to gate off spurious outputs generated by the receiver when no optical input is available. The outputs are open emitter ECL requiring termination (510 ohms to V_{EE} is recommended).

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Absolute Maximum Ratings

Characteristic		Minimum	Maximum	Units
Storage Temperature		-55	+85	°C
Operating Temperature		-40	+70	°C
Supply Voltage[1]		-	+6.0	V
Input Voltage [2]		-	+6.0	V
Lead Soldering	Temperature	-	240	°C
	Time	-	10	sec

Notes:
1. Measured from V_{CC} to V_{EE}.
2. Measured with respect to V_{EE}.

Optical Fiber Bandwidth

Performance of a high speed fiber optic link will often be limited more by the modal and chromatic dispersion characteristics of the optical fiber than by the fiber attenuation. Modal disperson effects may be minimized by using graded index multimode fiber with a high (>500 MHz-Km) bandwidth-distance product. Chromatic dispersion (also called material dispersion) may be minimized by achieving a good match between the zero dispersion wavelength of the optical fiber and the center wavelength of the transmitter LED, and by keeping the LED spectral width as small as possible.

For achieving the rated performance of the DTL-1300-RXD, the optical signal rise time at the receiver due to dispersion effects should be 2.5 ns maximum. For further discussion of these issues and calculation aids for estimating fiber bandwidth and receiver rise times refer to PCO Application Note AN-007.

EMI Susceptibility

The cases of both the transmitter and receiver should be grounded to shield the internal circuitry. The power supply leads should be bypassed with RF quality capacitors (0.1microfarad) close to the package. On a noisy power supply bus the receiver may be further isolated by a PI filter.

Data Encoding

The receiver circuit utilizes capacitive interstage coupling which limits the permissible duty cycle variations in the serial data. A DC balanced optical signal generated by a scrambling or encoding circuit is optimal for this type of data link. Unrestricted NRZ or bursty transmissions will require special precautions.

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DTL-1300-RXD Recommended De-Coupling Circuit for -5.2 V Operation

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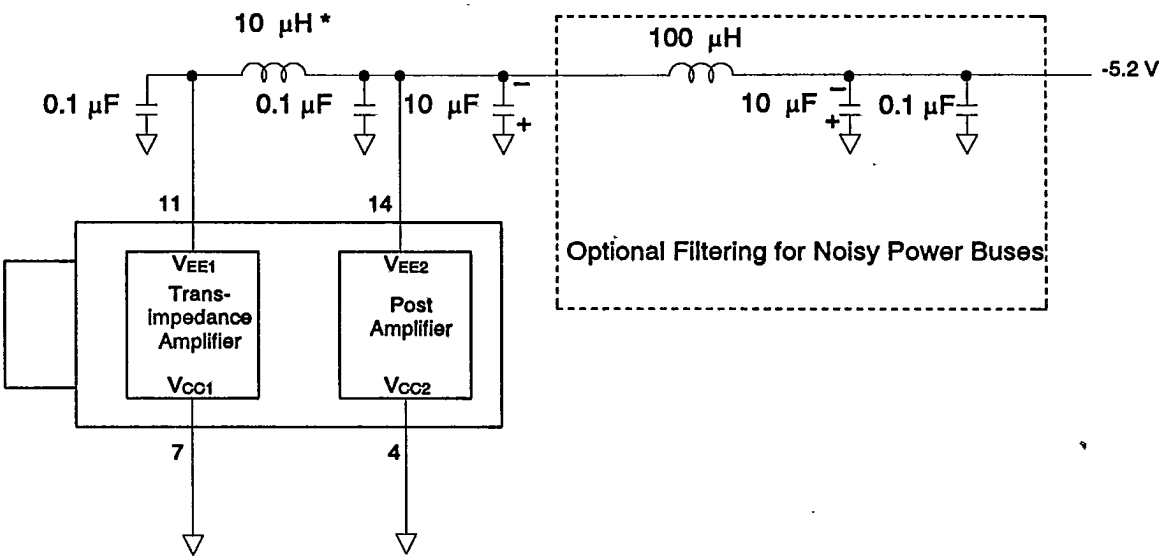
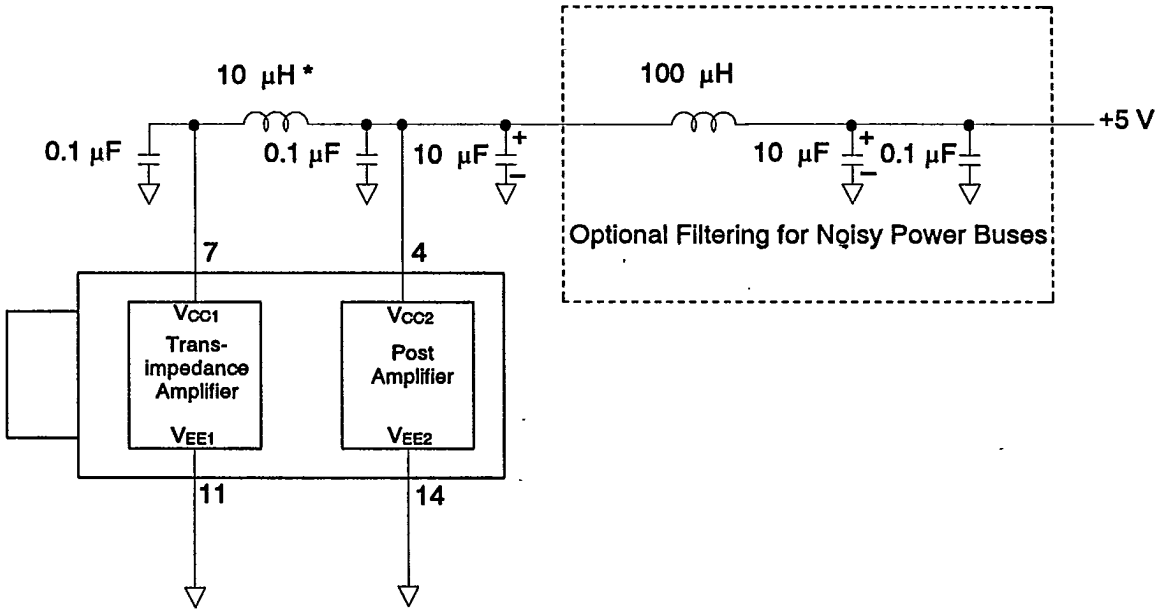


Case is isolated from V_{EE} and V_{CC}. Case grounding is required.

* I_{EE1} is 20 mA typical, 30 mA maximum. Series resistance of inductor should be 2 ohms or less.

DTL-1300-RXD Recommended De-Coupling Circuit for +5.0 V Operation



Case is isolated from V_{EE} and V_{CC}. Case grounding is required.

* I_{EE1} is 20 mA typical, 30 mA maximum. Series resistance of inductor should be 2 ohms or less.

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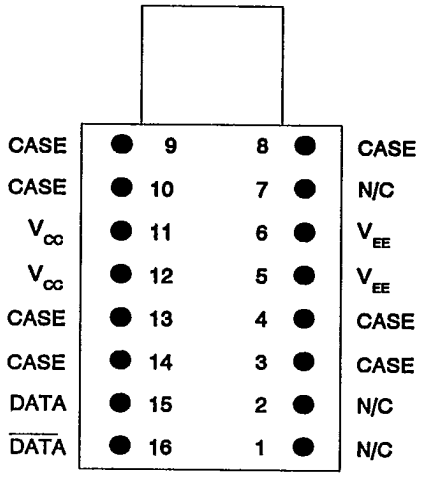
Pin Assignments (Top View)

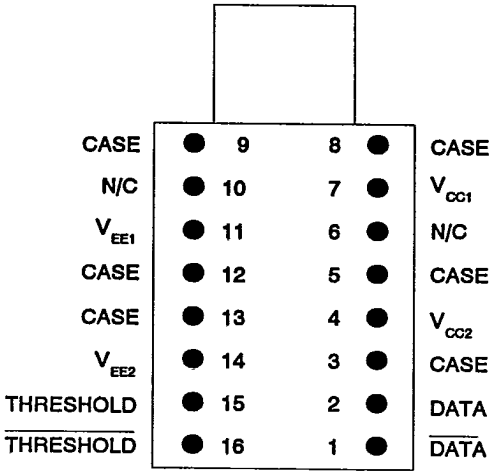
Transmitter

ST™ Connector Coupler



Receiver

ST™ Connector Coupler



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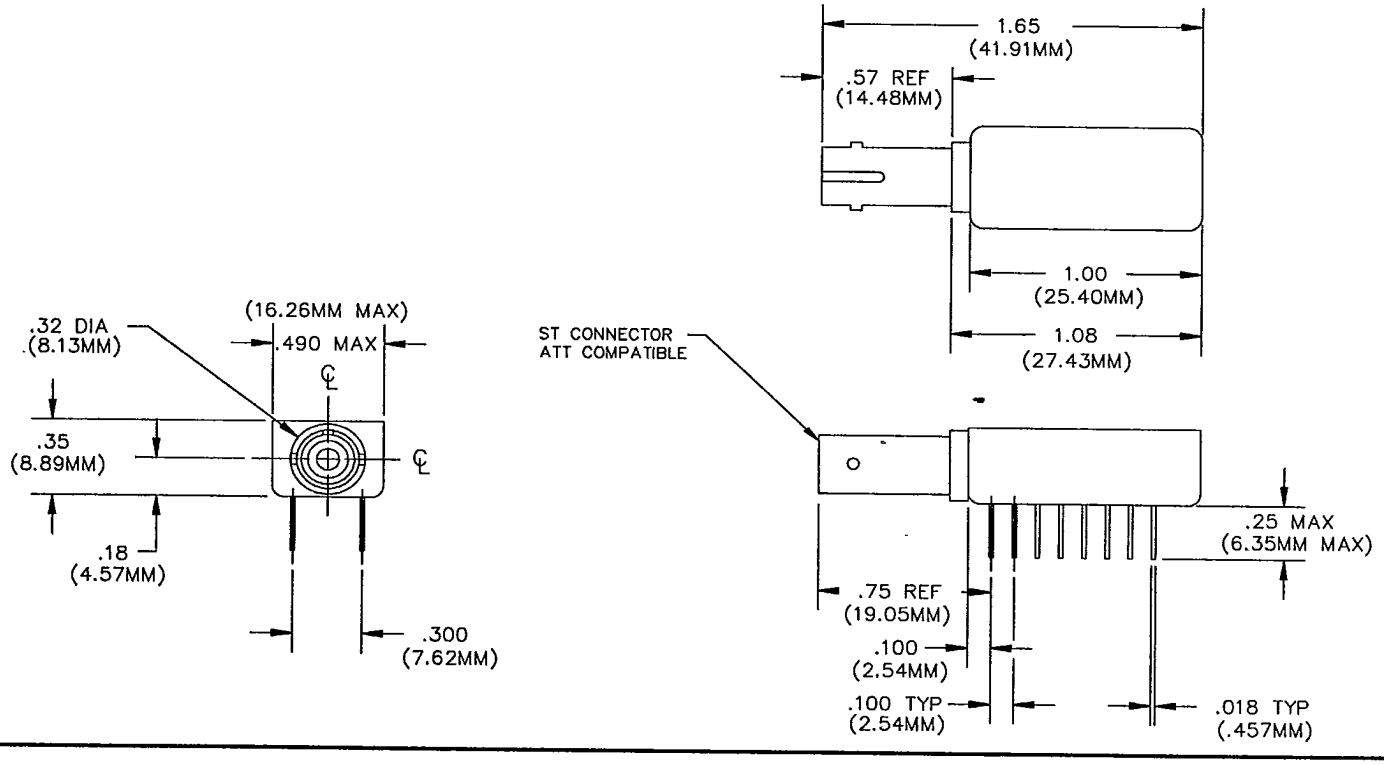
N/C — No internal connection

Outline Drawing



The metal housing is conductive and should be prevented from contacting circuit board traces or the sleeves of low profile screw machine sockets.

A thin plastic DIP insulator (such as BIVAR, Inc. Part Number 816-030 or equivalent) is recommended.

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Application Examples

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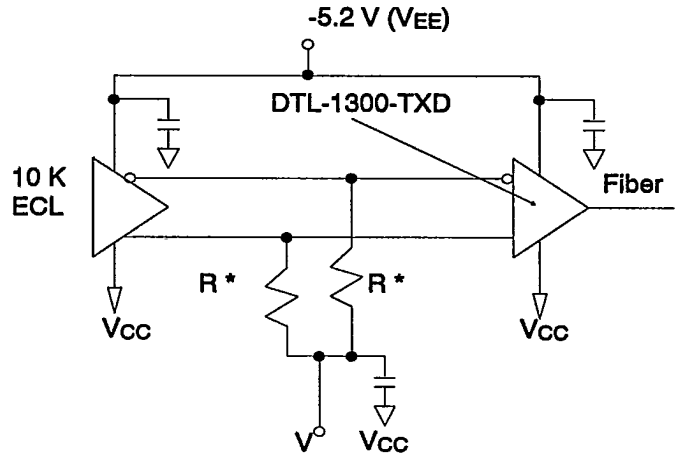
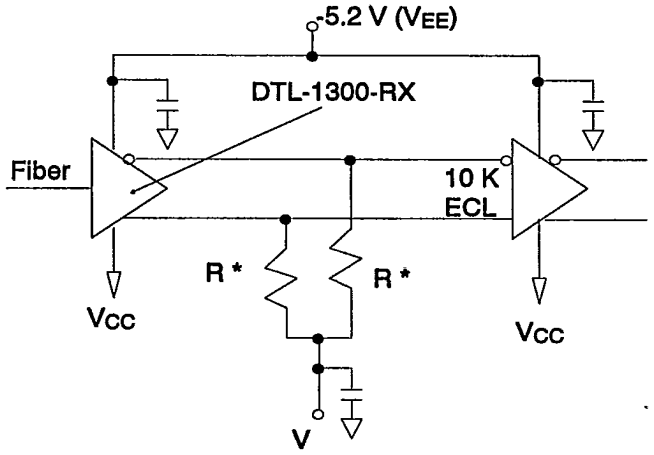
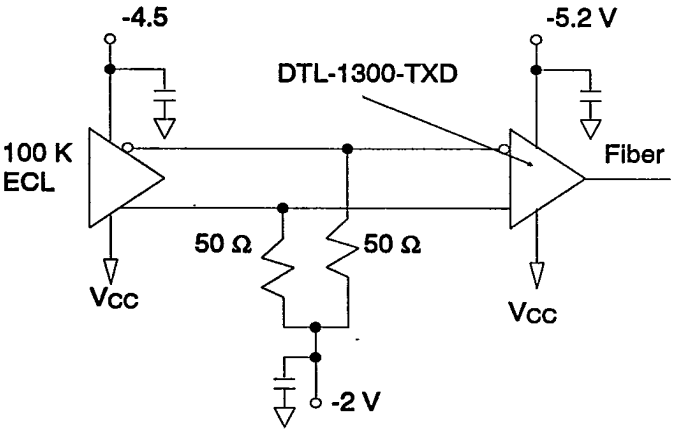
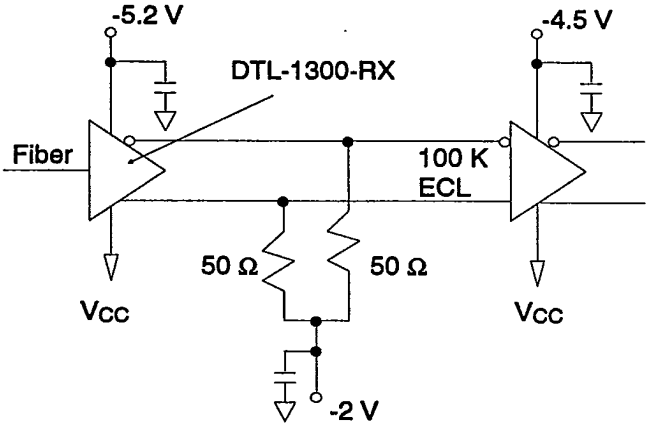
10 K ECL Typical Interface Configuration





100 K ECL Typical Interface Configuration





* If V = -5.2 V, then R = 510 Ω
If V = -2 V, then R = 50 Ω

Note: If positive supply voltage is used for both DTL-1300-RXD/TXD and ECL 10 K gate (V_{CC} = 5.0 V, V_{EE} = 0 V), they are still logically fully compatible and can have the common power supply voltage.

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Ordering Information

Complete Optical Data Link	Transmitter Module	Receiver Module
DTL-1300D	DTL-1300-TXD	DTL-1300-RXD

HANDLING PRECAUTIONS:
Normal handling precautions for electrostatic-sensitive devices should be taken.

PRELIMINARY DATA

This data sheet contains preliminary data. Supplementary data will be published at a later date. PCO, Incorporated reserves the right to make changes at any time without notice.

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For application assistance contact the PCO Application Engineering Staff.

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