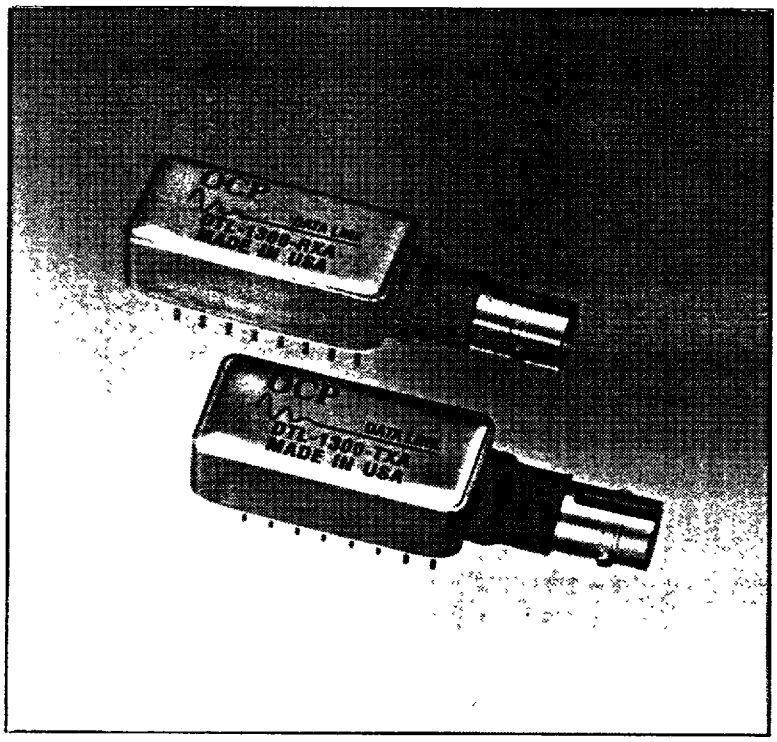
OCP

T-41-91

DTL-1300 Hermetic Data Link Modules



Features

- ☐ *Three High Speed Versions*
  - *100 Mb/s*
  - *160 Mb/s*
  - *220 Mb/s*
- ☐ *1320 nm Wavelength Operation*
- ☐ *15 to 19 dB Link Budget with 62.5/125 micron Fiber*
- ☐ *Standard Logic Interface — 10 K and 100 K ECL Compatible*
- ☐ *Single Supply Voltage (+5 V or -5.2 V)*
- ☐ *Small 16-Pin Hermetic Metal Packages*
- ☐ *-40°C to +70°C Operating Temperature Range **

* Extended operating range to +85°C is also available.

Description

The DTL-1300 Data Links are high performance transmitter/receiver modules designed for use with multimode optical fiber. Data rates from 1 to 220 Mb/s and distances of 2 kilometers or more are 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.

Although the DTL-1300 is a commercial product, its 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.

DTL-1300 Series modules are also available which have been customized at 45 and 270 Mbaud as well as for 50μm fiber. Transmitter modules with Transmit Disable control and V_{BB} output can also be provided.

Transmitter Performance Characteristics (T_a = +25°C)

	Symbol	Minimum	Typical	Maximum	Units
Electrical Interface					
Supply Voltage [1]	V_{EE}	-5.7	-5.2	-4.7	V
Supply Current	I_{EE}	-	105	130	mA
Power Dissipation	P	-	550	750	mW
Optical Interface					
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	170	nm
Temperature Coefficient of $\Delta\lambda$	-	-	+0.4	-	nm/°C
Type A (100 Mb/s)					
Optical Output Power [2,3]	$\overline{P}_o$	-17.0	-15.0	-	dBm
Rise/Fall Time [4]	t_r/t_f	-	4.0	5.0	ns
Data Rate	B	DC	-	100	Mb/s
Type B (160 Mb/s)					
Optical Output Power [2,3]	$\overline{P}_o$	-18.0	-16.0	-	dBm
Rise/Fall Time [4]	t_r/t_f	-	2.5	3.0	ns
Data Rate	B	DC	-	160	Mb/s
Type C (220 Mb/s)					
Optical Output Power [2,3]	$\overline{P}_o$	-19.0	-17.0	-	dBm
Rise/Fall Time [4]	t_r/t_f	-	2.2	2.5	ns
Data Rate	B	DC	-	220	Mb/s

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 with 50% duty cycle drive signal.
3. Approximately 4.5 dB less power coupled into 50/125 micron graded index 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} (V_{CC} -1.32 volts)

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).

Receiver Performance Characteristics (T_a = +25°C)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Electrical Interface						
Supply Voltage [1]		V_{EE}	-5.7	-5.2	-4.7	V
Supply Current [2]		I_{EE}	-	60	80	mA
Power Dissipation		P	-	300	450	mW
Optical Interface						
Data Rate	Type A	B	1	-	100	Mb/s
	Type B	B	1	-	160	Mb/s
	Type C	B	1	-	220	Mb/s
Sensitivity (10^{-12} BER) [3, 6]		$\overline{P}_{IN}$	-34	-36	-	dBm
Dynamic Range			18	20	-	dB
Temperature Derating(-40°C to +70°C) [4]			-1	0	+1	dB
Wavelength of Operation		λ	1100	1320	1600	nm
Carrier Detection Level [5]		$\overline{P}_{CD}$	-42	-37	-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 (2^7 - 1 PRBS test pattern).
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 -33 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.
6. For Type C, sensitivity is measured and specified at 200 Mb/s.

Receiver Signal Interface

Parameter	Symbol	Minimum	Maximum	Units
Output HIGH Voltage (Data, $\overline{Data}$)	V_{OH}	V_{CC} -1.025	V_{CC} -0.88	V
Output LOW Voltage (Data, $\overline{Data}$)	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. For optimum performance, both outputs should be terminated in the same manner, even if only one is used.

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).

Except for the final ECL output stage, the DTL-1300 Series receivers are high gain, wide bandwidth analog components. To achieve the best performance in terms of receiver sensitivity and threshold circuit operation, good grounding and isolation from power supply noise are essential.

Absolute Maximum Ratings

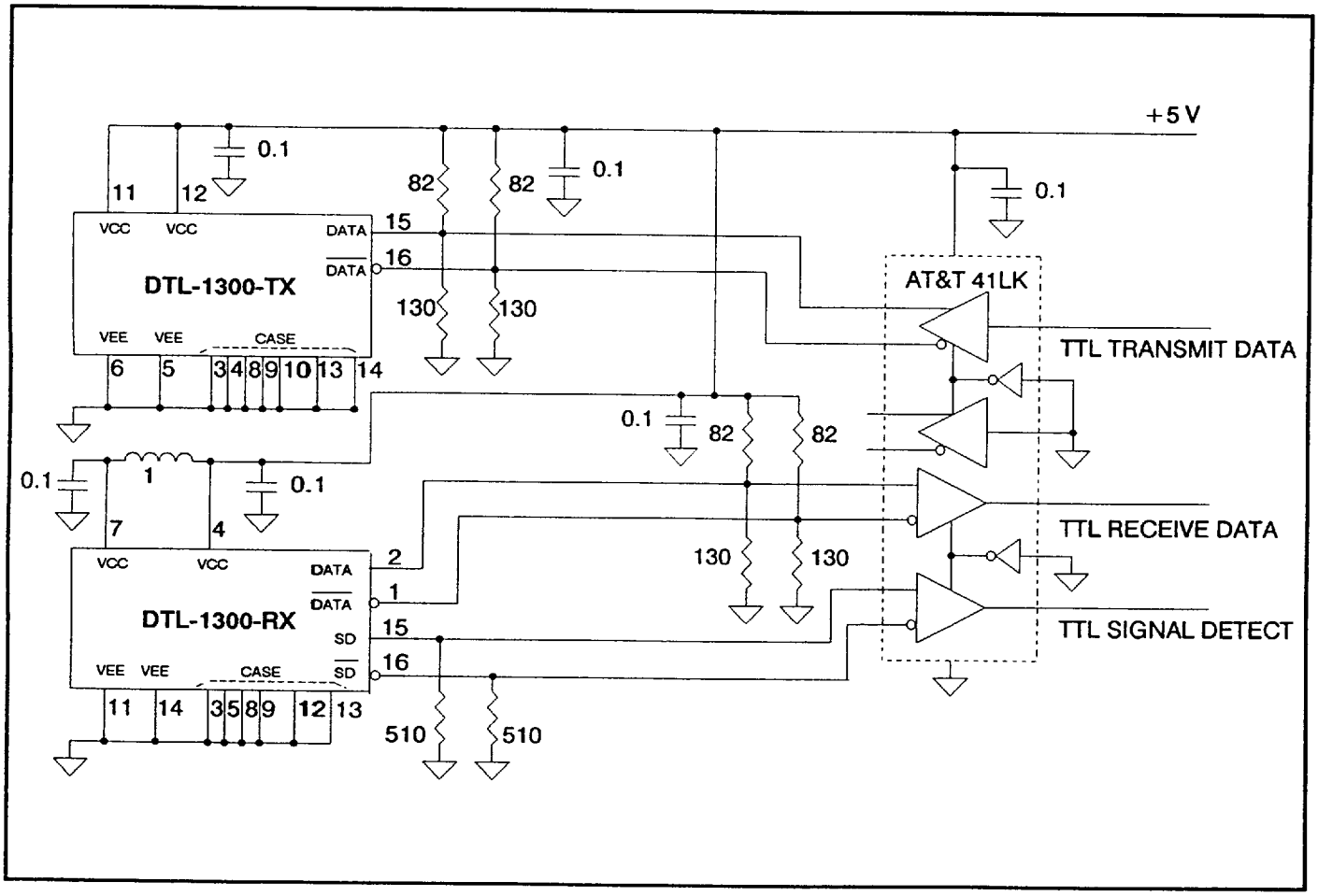
Characteristic		Minimum	Maximum	Units
Storage Temperature		-55	+100	°C
Operating Temperature		-40	+85	°C
Supply Voltage[1]		-	+6.0	V
Input Voltage [2]		-	+6.0	V
Lead Soldering	Temperature	-	240	°C
	Time	-	10	sec

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

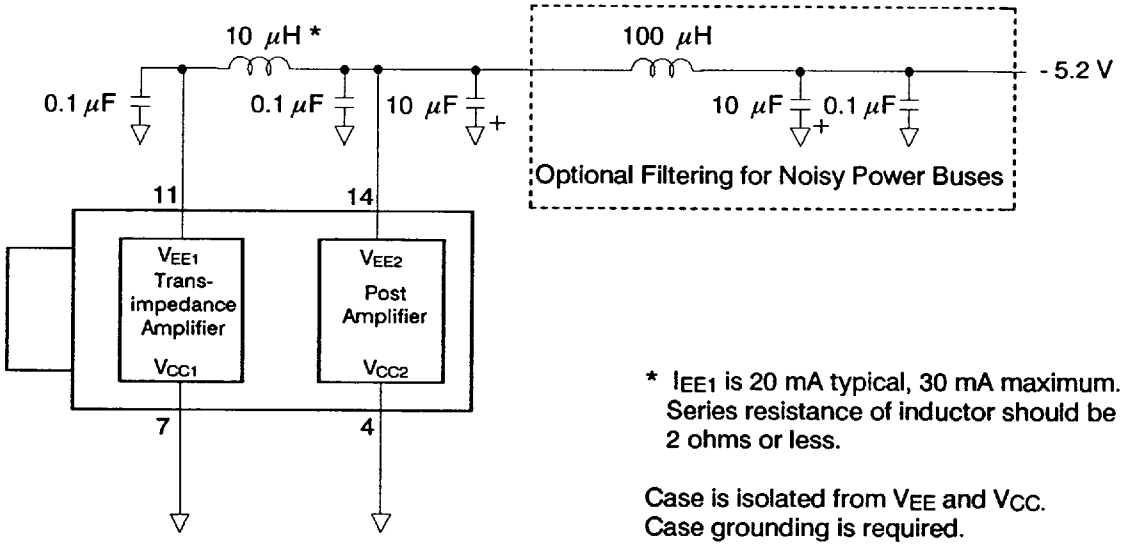
Data Encoding

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.

Interfacing with TTL Circuits



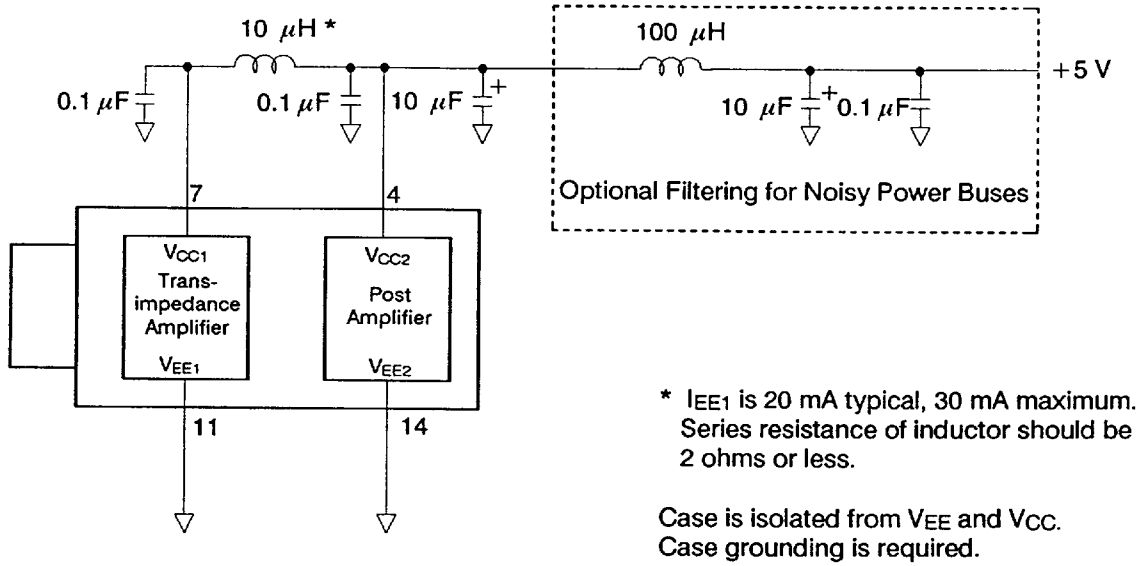
DTL-1300-RX Recommended De-Coupling Circuit for - 5.2 V Operation



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. To isolate the receiver from power supply noise, the receiver should be further isolated by a PI filter. A solid ground plane under and around the receiver is highly recommended.

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



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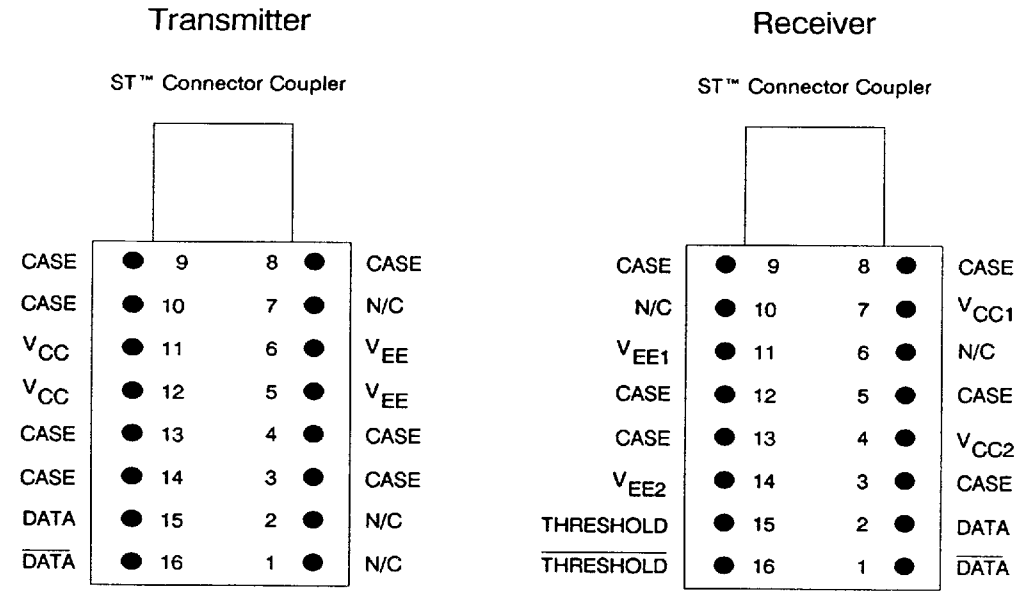
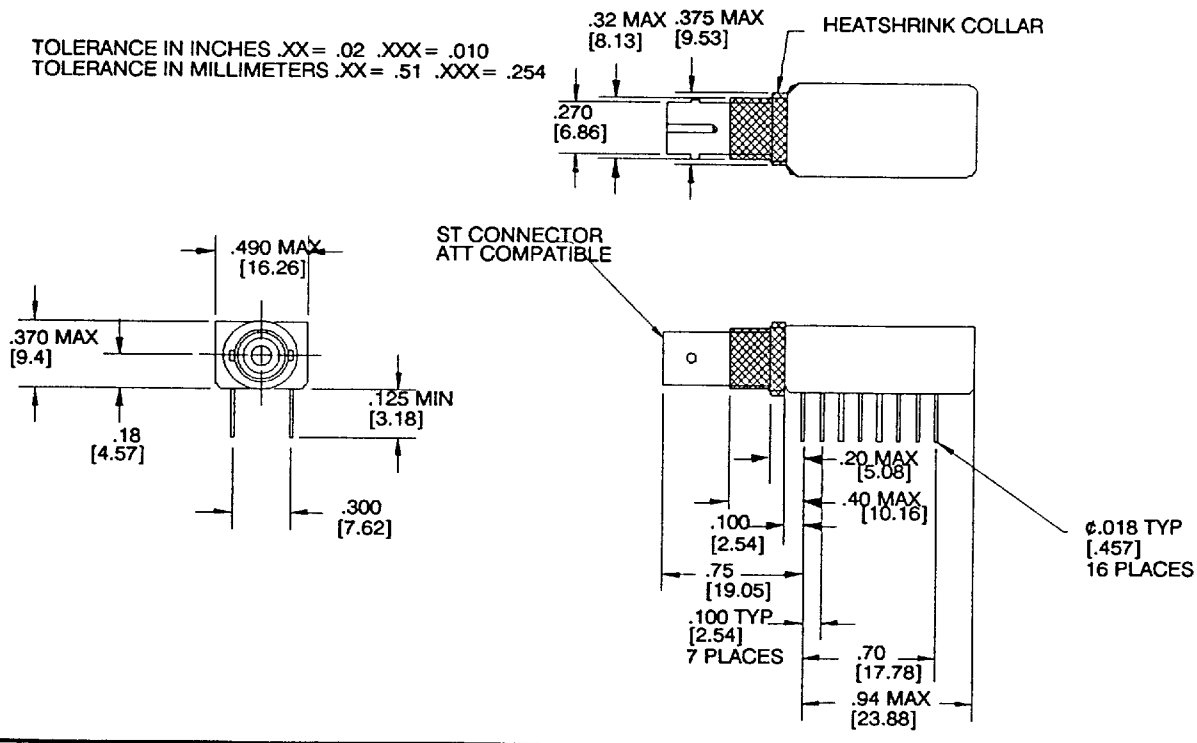
Pin Assignments (Top View)



ST is a trademark of AT&T

N/C — No internal connection

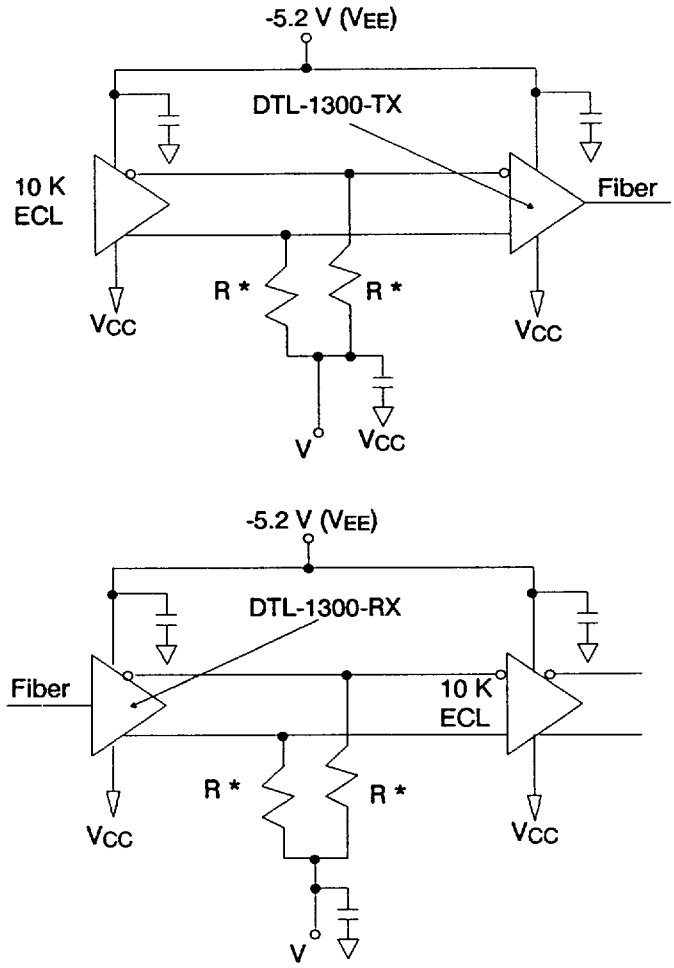
Outline Drawing



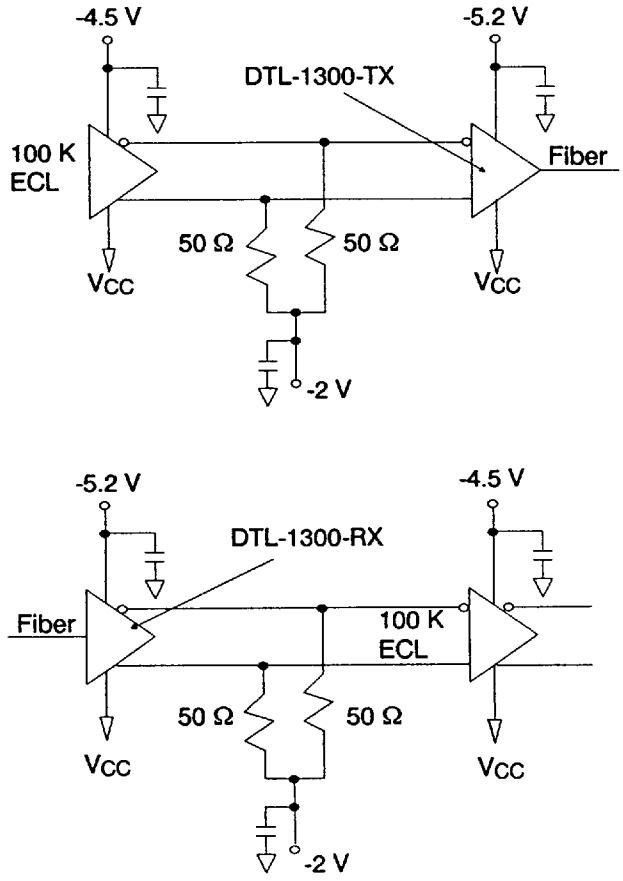
The metal housing is conductive and should be prevented from contacting circuit board traces or the sleeves of low profile screw machine sockets. A thin plastic DIP insulator (such as BIVAR, Inc. Part Number 816-030 or equivalent) is recommended.

Application Examples

10 K ECL Typical Interface Configuration



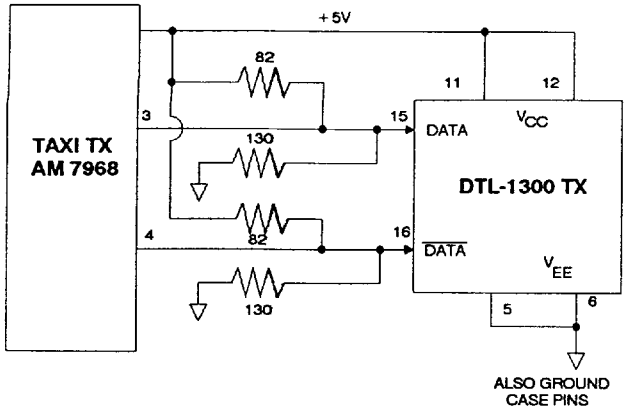
100 K ECL Typical Interface Configuration

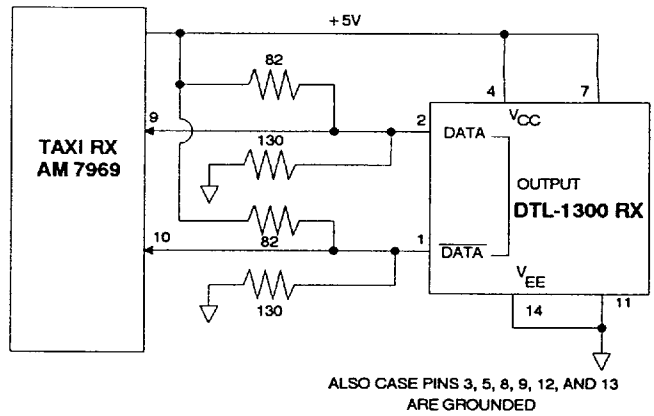


* If V = -5.2 V, then R = 510 Ω
  If V = -2 V, then R = 50 Ω

Note: If positive supply voltage is used for both a DTL-1300-RX/TX and an 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.

Application Examples





Ordering Information

Complete Optical Data Link	Transmitter Module	Receiver Module
DTL-1300A	DTL-1300-TXA	DTL-1300-RXA
DTL-1300B	DTL-1300-TXB	DTL-1300-RXB
DTL-1300C	DTL-1300-TXC	DTL-1300-RXC

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

Optical Communication Products, Inc.
9736 Eton Avenue
Chatsworth, CA 91311
Phone: 818 -701-0164
Fax: 818-701-1468