MC1584L

MONOLITHIC DUAL MDTL/MTTL RECEIVER

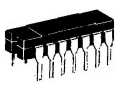
. . . designed with an active pull-up output that switches in response to a differential input voltage. This silicon device is compatible with the MDTL and MTTL digital logic families. Excellent common-mode input voltage range makes the device ideal for receiving digital information in a noisy environment. The "totem-pole" output (active pullup configuration) affords satisfactory response coupled with power savings for operation with a small number of unit loads. Typical applications include line sharing, voltage comparator, and logic level translation.

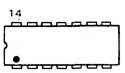
- High Input Impedance – 7.0 k ohms @ 10 MHz typ
- Low Propagation Delay Time – 37 ns max
- Wide Common–Mode Input Voltage Range ±3.5 Volts min
- Device Compatibility with other Members of the Line Driver/ Receiver Series

DUAL MDTL/MTTL RECEIVER (ACTIVE PULLUP) INTEGRATED CIRCUIT

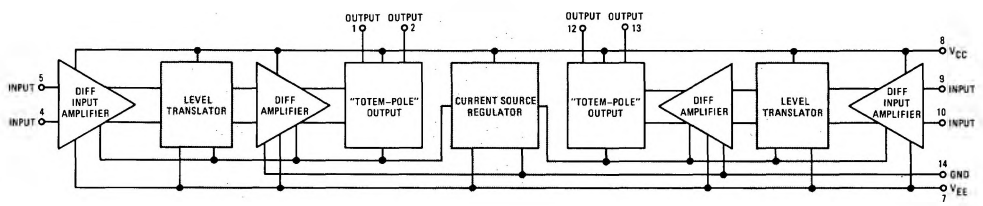
EPITAXIAL PASSIVATED

CERAMIC PACKAGE
CASE 632
TO-116

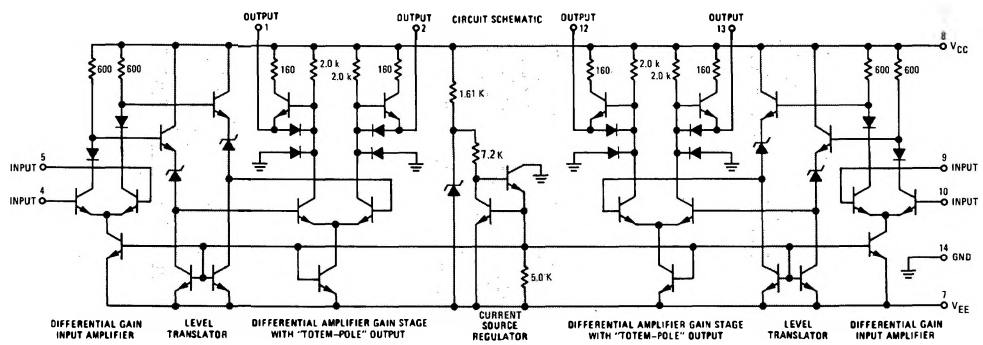




BLOCK DIAGRAM



CIRCUIT SCHEMATIC



See Packaging Information Section for outline dimensions.

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC} V_{EE}	+7.0 −7.0	Vdc
Differential−Mode Input Signal Voltage	V_{in}	±7.0	Volts
Common−Mode Input Signal Voltage	CMV_{in}	±10	Volts
Power Dissipation (Package Limitation) Ceramic Dual In-Line Package Derate above T_A = +25°C	P_D $1/\theta J_A$	 575 3.85	 mW mW/°C
Operating Temperature Range	T_A	−55 to +125	°C
Storage Temperature Range	T_{stg}	−65 to +175	°C

ELECTRICAL CHARACTERISTICS (Each Receiver, V_{EE} = +5.0 V, V_{CC} = −5.0 V, T_A = +25°C unless otherwise noted)

Characteristic	Figure	Symbol	Min	Typ	Max	Unit
Operating Supply Currents	1	I_{CC} I_{EE}	− −	11.5 25	15 31	mA
Input Leakage Current	1	I_R	−	0.009	0.1	μA
Input Current T_A = −55°C T_A = +25°C T_A = +125°C	1	I_{in}	 − − −	 0.024 0.016 0.011	 0.1 0.1 0.1	mA
Output Voltage High (I_{OH} = −0.7 mA) T_A = −55°C T_A = +25°C T_A = +125°C	1	V_{OH}	 2.4 2.4 2.4	 4.0 4.0 4.0	 − − −	Volts
Output Voltage Low (I_{OL} = 4.0 mA) T_A = −55°C to +125°C	1	V_{OL}	 −	 100	 400	mV
Output Short−Circuit Current	1	I_{SC}	−	30	40	mA
Input Voltage Transition Width* T_A = −55°C T_A = +25°C T_A = +125°C		V_{TR}	 − − −	 20 25 30	 60 60 60	mV
Switching Times Propagation Delay Time Rise Time Fall Time	2	 t_{pd^+} t_{pd^-} t_r t_f	 − − − −	 32 28 14 12	 37 33 − −	ns
Parallel Input Impedance (f = 5.0 MHz) Capacitance Resistance		 $C_{p(in)}$ $R_{p(in)}$	 − −	 5.0 11	 − −	 pF k ohms
Common−Mode Input Voltage Range T_A = −55 to +125°C	3	$CMVR_{in}$	+3.5 -3.5	+4.3 −4.2	− −	Volts
Power Supply Operating Range		V_{CC} V_{EE}	+4.75 -4.75	+5.0 −5.0	+6.0 -6.0	Vdc
Power Dissipation		P_D	−	170	200	mW

Ground all unused input pins to assure correct device biasing.

*Measured from points of unity gain.

CHARACTERISTIC DEFINITIONS

FIGURE 1 – TERMINAL CURRENTS

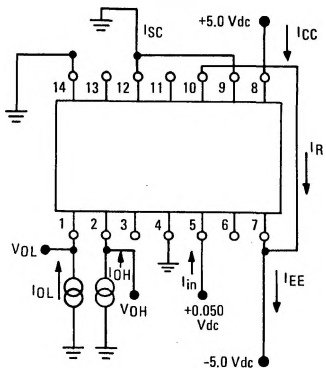


FIGURE 2 – TRANSIENT RESPONSE

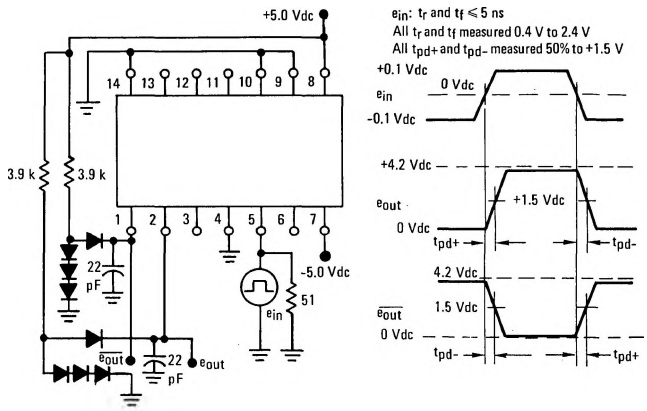
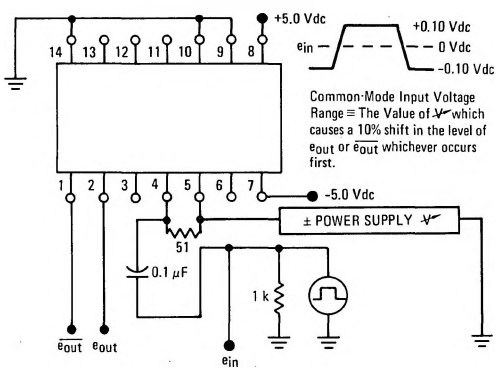


FIGURE 3 – COMMON-MODE INPUT VOLTAGE RANGE



TYPICAL CHARACTERISTICS

(V_{EE} = +5.0 Vdc, V_{CC} = -5.0 Vdc, T_A = +25°C unless otherwise noted)

FIGURE 4 – OUTPUT VOLTAGE HIGH versus SUPPLY OPERATING VOLTAGE AND TEMPERATURE

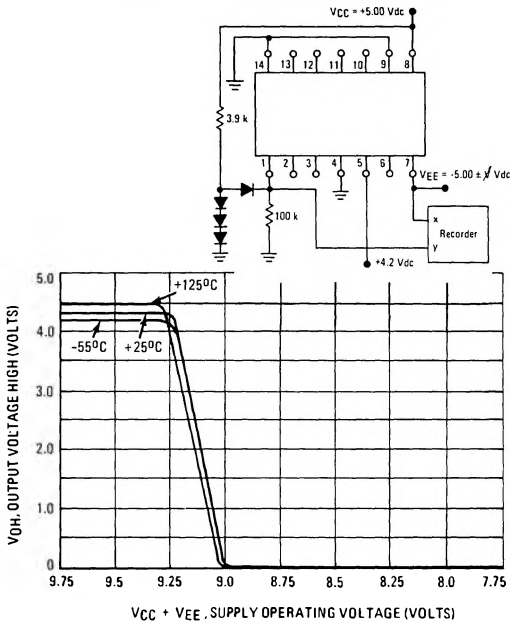


FIGURE 5 – OUTPUT VOLTAGE versus DIFFERENTIAL INPUT VOLTAGE AND TEMPERATURE

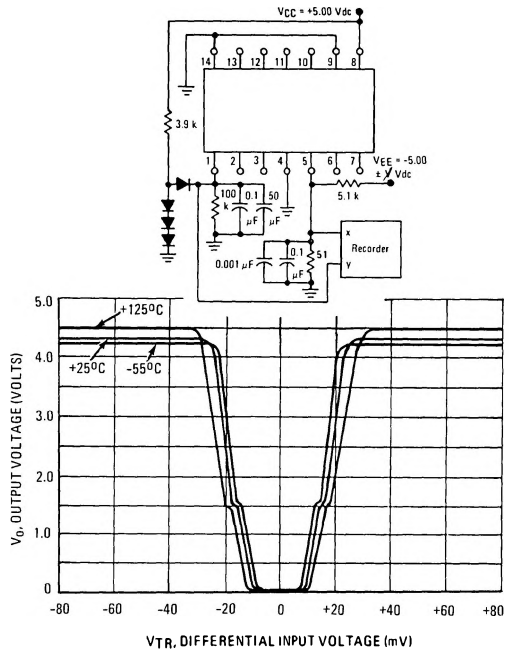


FIGURE 6 – OUTPUT VOLTAGE versus DIFFERENTIAL INPUT VOLTAGE AND VARIOUS LOADS

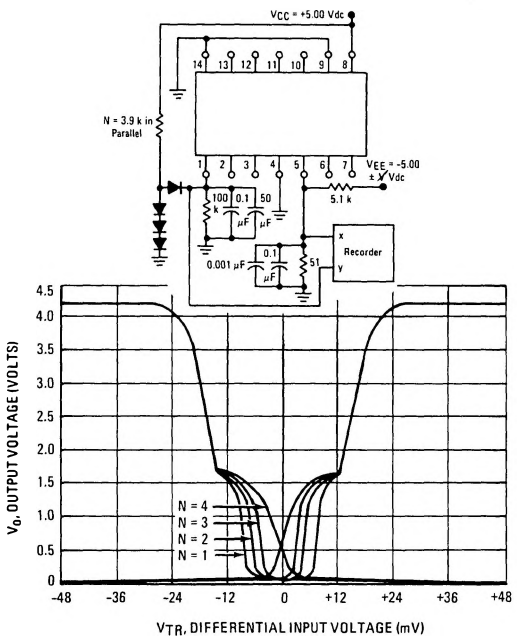
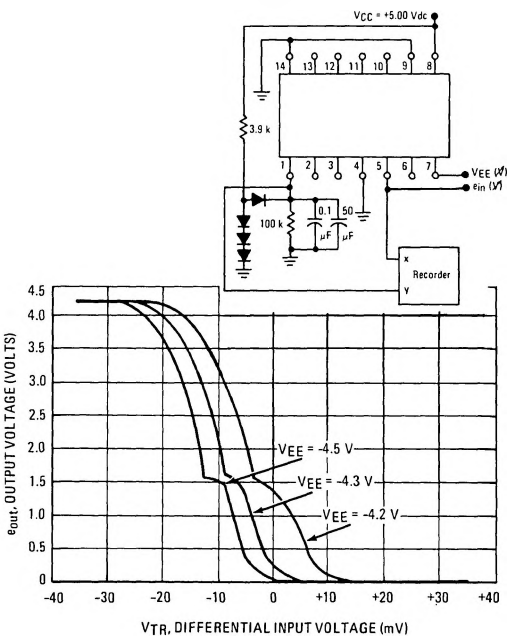


FIGURE 7 – OUTPUT VOLTAGE versus DIFFERENTIAL INPUT VOLTAGE AND VARIATIONS IN NEGATIVE SUPPLY



TYPICAL CHARACTERISTICS (continued)

FIGURE 8 – PROPAGATION DELAY versus DIFFERENTIAL INPUT VOLTAGE

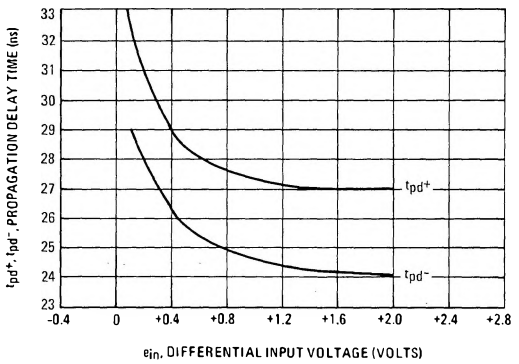


FIGURE 9 – PROPAGATION DELAY versus AMBIENT TEMPERATURE

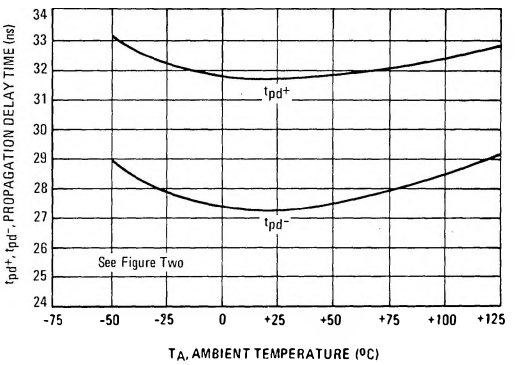
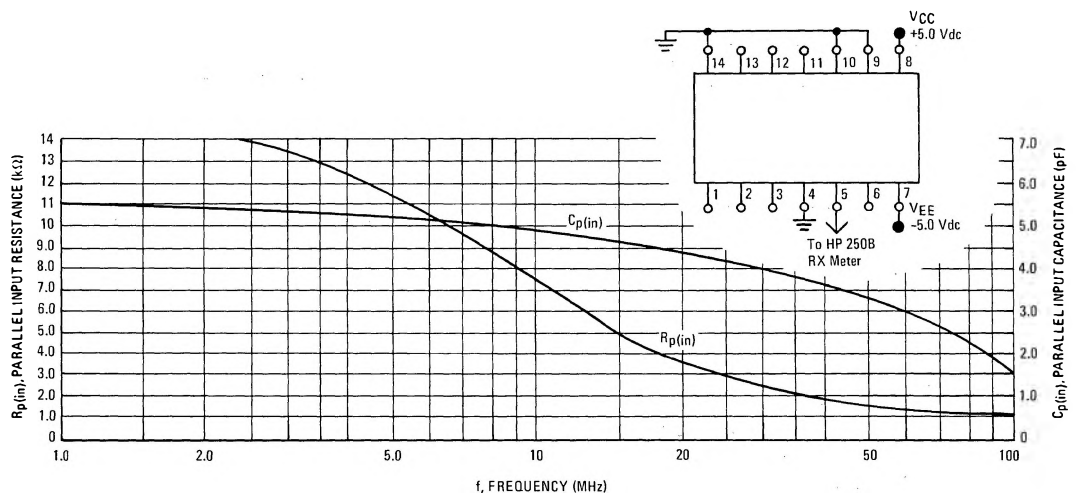


FIGURE 10 – PARALLEL INPUT IMPEDANCE versus FREQUENCY



APPLICATIONS INFORMATION

Lina Driver/Receiver Family Characteristics

The Motorola line driver/receiver series provides interface circuits for driving digital data transmission lines, e.g., coaxial cable or twisted pair. The digital data transmission is via a balanced differential mode. The line drivers and receivers are designed to provide high common-mode noise rejection, present high impedances to the transmission line and have low propagation times. A feature of the drivers is the capability to operate in a party-line mode whereby a number of drivers can be connected to a single line. This series provides drivers and receivers compatible with MRTL, MDTL, MTTL and MECL. The five circuits of the family are:

MC1580L	Dual Line Driver/Receiver
MC1581L	Dual MECL Receiver
MC1582L	Dual MDTL/MTTL Driver
MC1583L	Dual Receiver (Open Collector)
MC1584L	Dual Receiver (Active Pullup)

Figure 11 indicates the line drivers and receivers recommended for interfacing with each of the various digital logic families.

These five circuits are extremely useful in numerous applications other than line drivers and receivers. The differential amplifier input of the receiver makes it useful in applications such as voltage comparators, waveform generators and high-input-impedance buffers. The drivers and receivers are useful as logic level translators.

FIGURE 11

Digital Logic Family	Driver	Receiver
MECL	MC1580L	MC1581L
MDTL	MC1582L	MC1583L MC1584L
MTTL	MC1582L	MC1583L MC1584L
MRTL	MC1580L MC1582L	MC1583L

The MC1584L in Figure 12 serves as the line receiver in a balanced differential transmission line. The outputs of the receiver and the inputs to the driver are compatible with MTTL and MDTL circuits. The MC1584L contains an active pullup circuit in the output stage. The MC1583L receiver can also be used for MTTL or MDTL systems. The open collector outputs of the MC1583L require external pullup resistors but is designed to sink up to 20 mA.

While common-mode noise is the major concern in a twisted pair transmission line; a good data transmission system must offer some immunity from differential-mode voltages that may be present due to mismatches in termination impedances. The drivers and receivers of the MC1580 Series are designed with this requirement in mind. The exact amount of noise immunity depends on line impedances but the following example shows how differential-mode noise immunity is calculated for a given system. For a line with a characteristic impedance of Z_O, calculate the minimum differential input voltage from the equation.

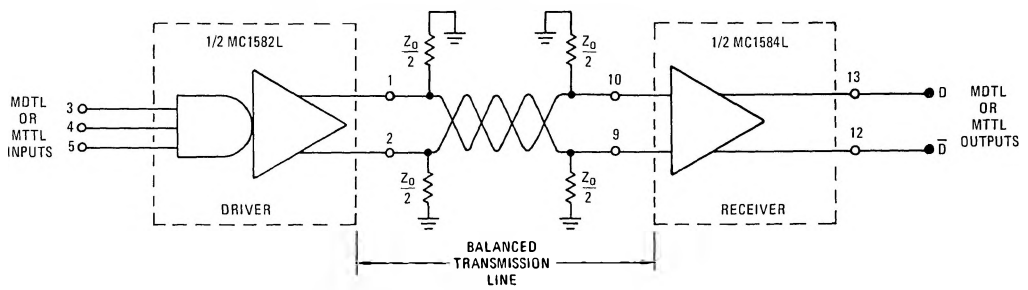
$$\pm V_{in} = \frac{I_O(min) \times Z_O}{4}$$

For a 170-ohm line, $V_{in} = \frac{(6.9)\ (170)}{4} = 0.29$ Volts.

Since the MC1584L requires a 50 mV maximum input differential to maintain the output state, the worst case differential-mode noise immunity is 0.26 V, (See Figure 13).

High input impedance of the MC1584L and high output impedance of the MC1582L minimize impedance discontinuities on the transmission line and allow many drivers and receivers to be connected to the line.

FIGURE 12 – MDTL, MTTL COMPATIBLE TRANSMISSION SYSTEM



APPLICATIONS INFORMATION (continued)

Use of the MC1584L in a bi-directional MDTL or MTTL compatible transmission system is shown in Figure 14. The drivers of Figure 14 are connected so that the current sources from both drivers pull current from the same wire of the twisted pair when both drivers are transmitting logic "0" signals. The external current source, I_S, supplies the current required by one driver. The current for the other driver is drawn from the termination impedances creating a voltage differential across the line. When either driver transmits a logic "1", a voltage difference of the opposite polarity is created across the line. For a system with two drivers the current source (I_S) can be supplied by a 600-ohm resistor connected to +5.0 Volts. If additional drivers are connected to the line, a matching current source must be connected for each added driver. The current sources are connected to the line so that when all drivers are transmitting logic "0"s, the difference in current drawn from the terminating resistors of the two wires in the twisted pair is equal to one current source (8.6 mA). The current sources should also be connected so that when any driver transmits a logic "1" a current difference of the opposite polarity exists. The matching current source should be the companion circuit on the various driver chips. The difference in amplitude of the two current sources on a single chip is specified to allow the system designer to calculate the maximum current source mismatch, ΔI_{OL}, and hence the maximum number of drivers that can be connected to a given transmission line.

The MC1584L has many other uses in a digital system. The high input impedance suggests its use as a buffer for delay lines and in waveform generation circuits.

FIGURE 13

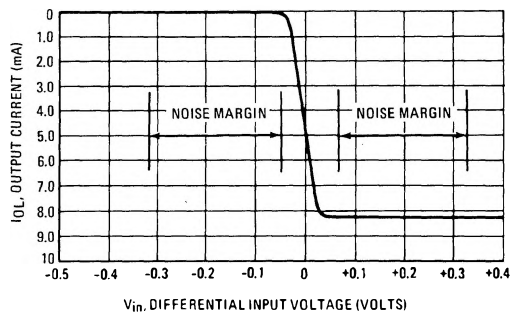


FIGURE 14 – BI-DIRECTIONAL TRANSMISSION SYSTEM

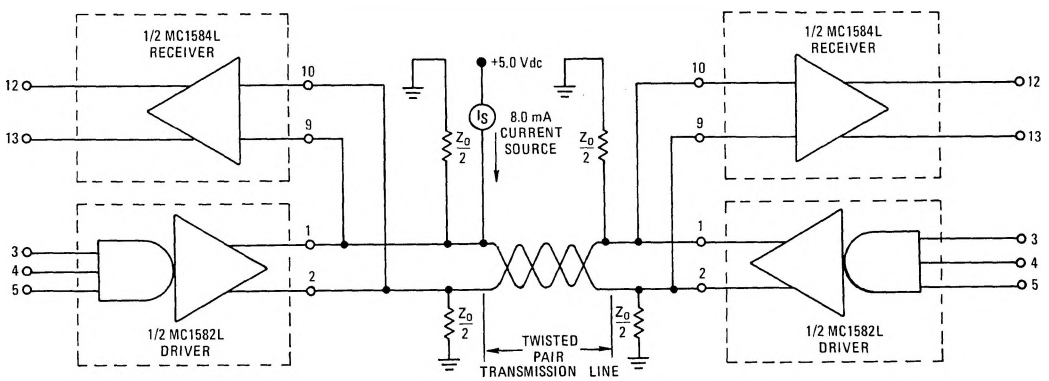
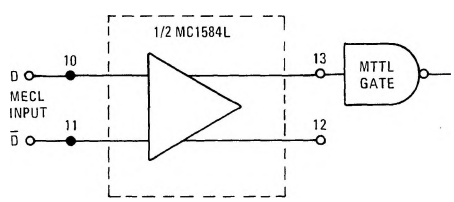


FIGURE 15 – MECL-TO-MTTL LEVEL TRANSLATOR



Voltage Translator

Translation of voltage levels from MECL (often used for the high-speed portion of a digital system) to MTTL (used in other slower portions of the system) is often required. The MC1584L can perform this function as indicated in Figure 15. The complements of the MECL input must be present unless a MECL bias source is available.