MC1489L
MC1489AL

QUAD LINE RECEIVERS

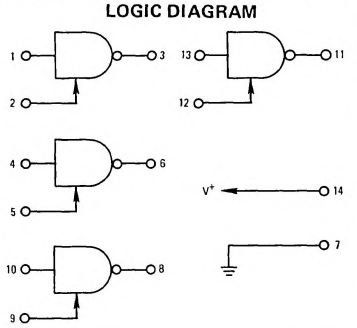
The MC1489 monolithic quad line receivers are designed to interface data terminal equipment with data communications equipment in conformance with the specifications of EIA Standard No. RS-232C.

- Input Resistance — 3.0 k to 7.0 kilohms
- Input Signal Range — ±30 Volts
- Input Threshold Hysteresis Built In
- Response Control
  a) Logic Threshold Shifting
  b) Input Noise Filtering

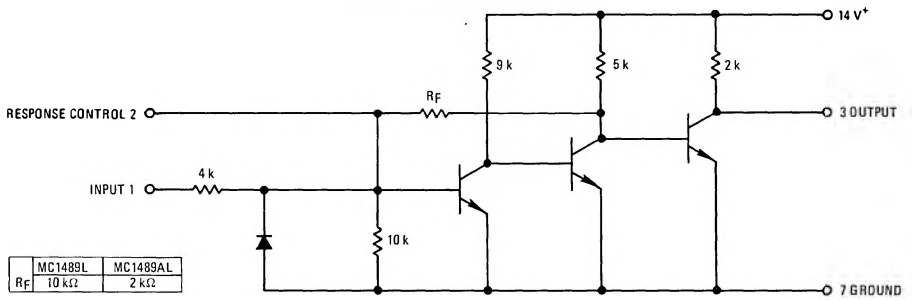
QUAD MDTL LINE RECEIVERS RS-232C

INTEGRATED CIRCUIT

LOGIC DIAGRAM

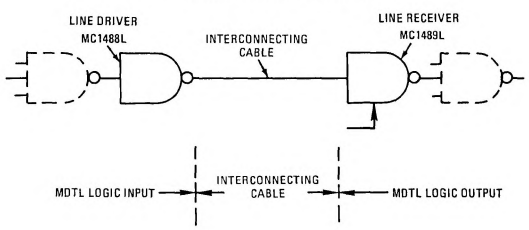


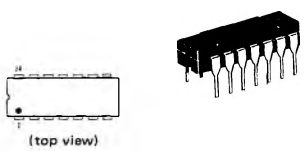
CIRCUIT SCHEMATIC (1/4 OF CIRCUIT SHOWN)



	MC1489L	MC1489AL
R_F	10 kΩ	2 kΩ

TYPICAL APPLICATION





CERAMIC PACKAGE
CASE 632
TO-116

See Packaging Information Section for outline dimensions.

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

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+	10	Vdc
Input Signal Range	V_{in}	±30	Vdc
Output Load Current	I_L	20	mA
Power Dissipation (Package Limitation, Ceramic Dual In-Line Package) Derate above T_A = +25°C	P_D $1/\theta_{JA}$	1000 6.7	mW mW/°C
Operating Temperature Range	T_A	0 to +75	°C
Storage Temperature Range	T_{stg}	-65 to +175	°C

ELECTRICAL CHARACTERISTICS (Response control pin is open.) (V^+ = +5.0 Vdc ± 1%, T_A = 0 to +75°C unless otherwise noted.)

Characteristics		Figure	Symbol	Min	Typ	Max	Unit
Positive Input Current	(V_{in} = +25 Vdc) (V_{in} = +3.0 Vdc)	1	I_{IH}	3.6 0.43	– –	8.3 –	mA
Negative Input Current	(V_{in} = -25 Vdc) (V_{in} = -3.0 Vdc)	1	I_{IL}	-3.6 -0.43	– –	-8.3 –	mA
Input Turn-On Threshold Voltage (T_A = +25°C, $V_{OL} \leq$ 0.45 V)	 MC1489L MC1489AL	2	V_{IH}	 1.0 1.75	 – 1.95	 1.5 2.25	Vdc
Input Turn-Off Threshold Voltage (T_A = +25°C, $V_{OH} \geq$ 2.5 V, I_L = -0.5 mA)	 MC1489L MC1489AL	2	V_{IL}	 0.75 0.75	 – 0.8	 1.25 1.25	Vdc
Output Voltage High	(V_{in} = 0.75 V, I_L = -0.5 mA) (Input Open Circuit, I_L = -0.5 mA)	2	V_{OH}	2.6 2.6	4.0 4.0	5.0 5.0	Vdc
Output Voltage Low	(V_{in} = 3.0 V, I_L = 10 mA)	2	V_{OL}	–	0.2	0.45	Vdc
Output Short-Circuit Current		3	I_{SC}	–	3.0	–	mA
Power Supply Current	(V_{in} = +5.0 Vdc)	4	I^+	–	20	26	mA
Power Dissipation	(V_{in} = +5.0 Vdc)	4	P_D	–	100	130	mW

SWITCHING CHARACTERISTICS (V^+ = 5.0 Vdc ± 1%, T_A = +25°C)

Propagation Delay Time	(R_L = 3.9 kΩ)	5	t_{pd+}	–	25	85	ns
Rise Time	(R_L = 3.9 kΩ)	5	t_r	–	120	175	ns
Propagation Delay Time	(R_L = 390 Ω)	5	t_{pd-}	–	25	50	ns
Fall Time	(R_L = 390 Ω)	5	t_f	–	10	20	ns

TEST CIRCUITS

FIGURE 1 – INPUT CURRENT

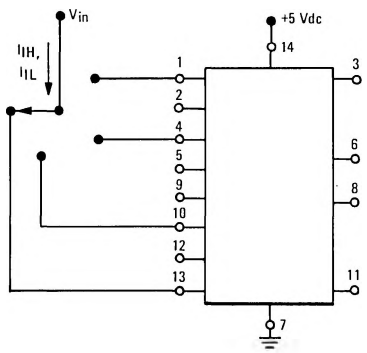


FIGURE 2 – OUTPUT VOLTAGE and INPUT THRESHOLD VOLTAGE

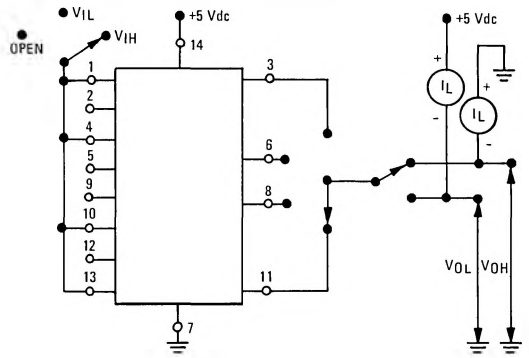


FIGURE 3 – OUTPUT SHORT-CIRCUIT CURRENT

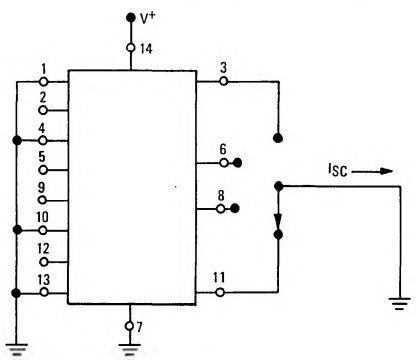


FIGURE 4 – POWER-SUPPLY CURRENT

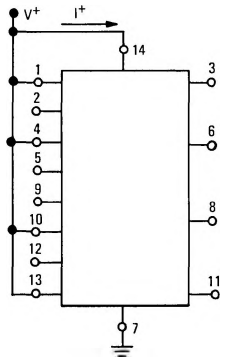


FIGURE 5 – SWITCHING RESPONSE

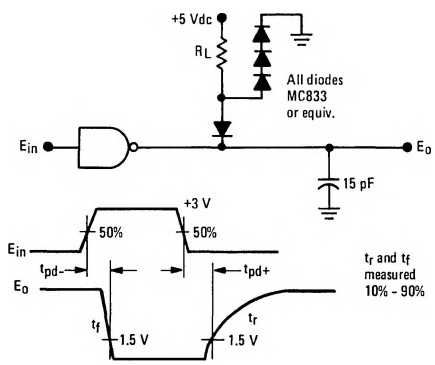
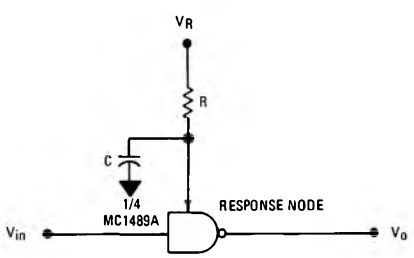


FIGURE 6 – RESPONSE CONTROL NODE



C, capacitor is for noise filtering.
R, resistor is for threshold shifting.

TYPICAL CHARACTERISTICS

(V^+ = 5.0 Vdc, T_A = +25°C unless otherwise noted)

FIGURE 7 – INPUT CURRENT

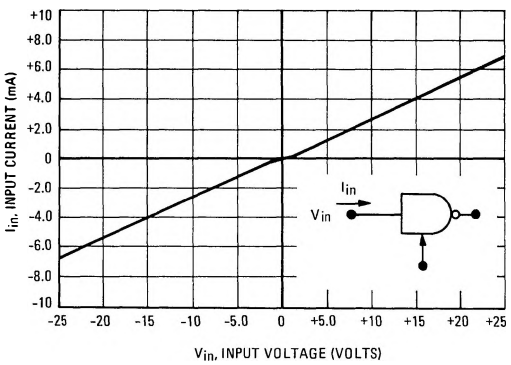


FIGURE 8 – MC1489 INPUT THRESHOLD VOLTAGE ADJUSTMENT

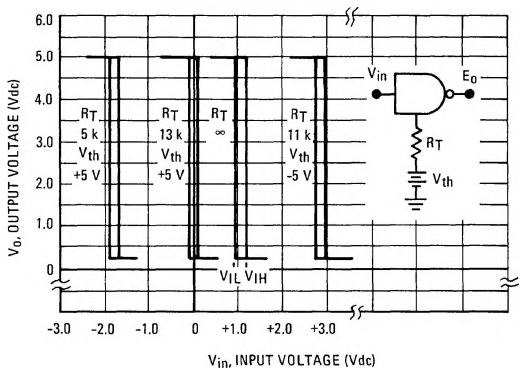


FIGURE 9 – MC1489A INPUT THRESHOLD VOLTAGE ADJUSTMENT

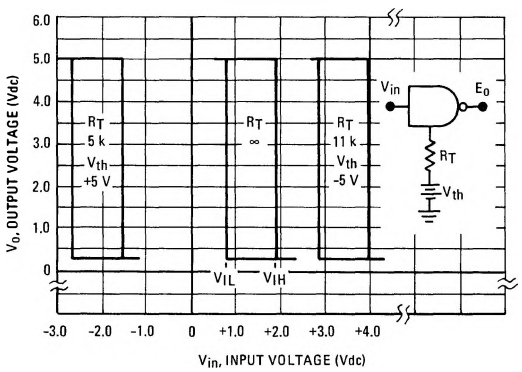


FIGURE 10 – INPUT THRESHOLD VOLTAGE versus TEMPERATURE

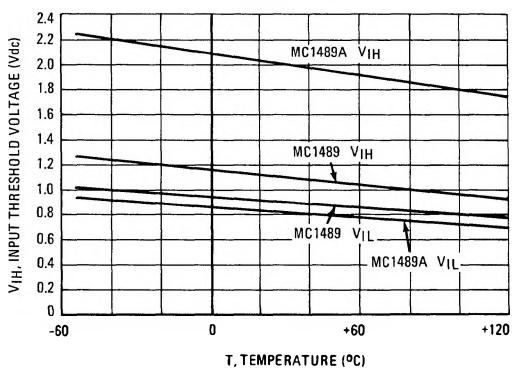
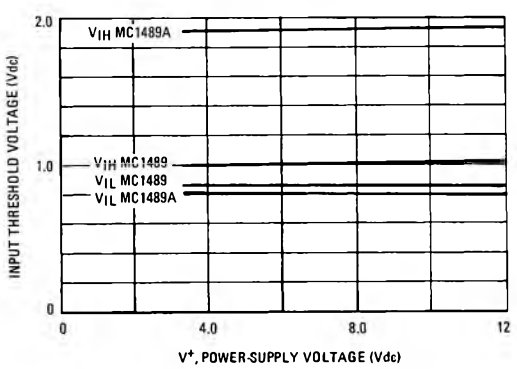


FIGURE 11 – INPUT THRESHOLD versus POWER-SUPPLY VOLTAGE



APPLICATIONS INFORMATION

General Information

The Electronic Industries Association (EIA) has released the RS-232C specification detailing the requirements for the interface between data processing equipment and data communications equipment. This standard specifies not only the number and type of interface leads, but also the voltage levels to be used. The MC1488L quad driver and its companion circuit, the MC1489L quad receiver, provide a complete interface system between DTL or TTL logic levels and the RS-232C defined levels. The RS-232C requirements as applied to receivers are discussed herein.

The required input impedance is defined as between 3000 ohms and 7000 ohms for input voltages between 3.0 and 25 volts in magnitude; and any voltage on the receiver input in an open circuit condition must be less than 2.0 volts in magnitude. The MC1489 circuits meet these requirements with a maximum open circuit voltage of one V_{BE} (Ref. Sect. 2.4).

The receiver shall detect a voltage between -3.0 and -25 volts as a logic "1" and inputs between +3.0 and +25 volts as a logic "0" (Ref. Sect. 2.3). On some interchange leads, an open circuit or "Power OFF" condition (300 ohms or more to ground) shall be decoded as an "OFF" condition or logic "1" (Ref. Sect. 2.5). For this reason, the input hysteresis thresholds of the MC1489 circuits are all above ground. Thus an open or grounded input will cause the same output as a negative or logic "1" input.

Device Characteristics

The MC1489 interface receivers have internal feedback from the second stage to the input stage providing input hysteresis for noise rejection. The MC1489L input has typical turn-on voltage of 1.25 volts and turn-off of 1.0 volt for a typical hysteresis of 250 mV. The MC1489AL has typical turn-on of 1.95 volts and turn-off of 0.8 volt for typically 1.15 volts of hysteresis.

Each receiver section has an external response control node in addition to the input and output pins, thereby allowing the designer to vary the input threshold voltage levels. A resistor can be connected between this node and an external power-supply. Figures 6, 8 and 9 illustrate the input threshold voltage shift possible through this technique.

This response node can also be used for the filtering of high-frequency, high-energy noise pulses. Figures 12 and 13 show typical noise-pulse rejection for external capacitors of various sizes.

These two operations on the response node can be combined or used individually for many combinations of interfacing applications. The MC1489 circuits are particularly useful for interfacing between MOS circuits and MDTL/MTTL logic systems. In this application, the input threshold voltages are adjusted (with the appropriate supply and resistor values) to fall in the center of the MOS voltage logic levels. (See Figure 14)

The response node may also be used as the receiver input as long as the designer realizes that he may not drive this node with a low impedance source to a voltage greater than one diode above ground or less than one diode below ground. This feature is demonstrated in Figure 15 where two receivers are slaved to the same line that must still meet the RS-232C impedance requirement.

FIGURE 12 – MC1489 NOISE REJECTION

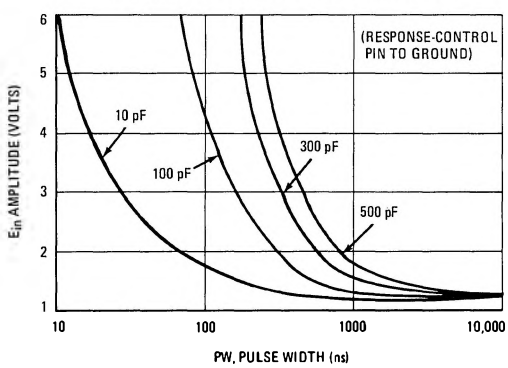
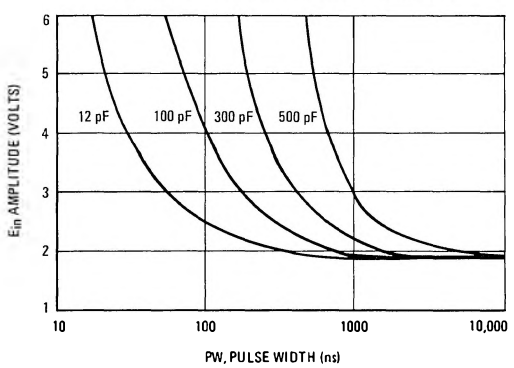


FIGURE 13 – MC1489A NOISE REJECTION



APPLICATIONS INFORMATION (continued)

FIGURE 14 – TYPICAL TRANSLATOR APPLICATION – MOS TO DTL OR TTL

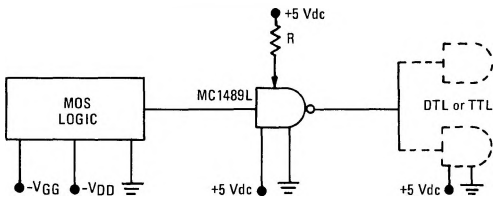


FIGURE 15 – TYPICAL PARALLELING OF TWO MC1489,A RECEIVERS TO MEET RS-232C