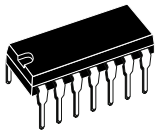
# MC1489
# MC1489A

## Quad line receivers

## General features

- Input resistance –3k to 7kΩ
- Input signal range ± 30V
- Input threshold hysteresis built-in
- Response control:
  a) Logic threshold shifting
  b) Input noise filtering



DIP

SOP

## Description

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 N° RS232C.



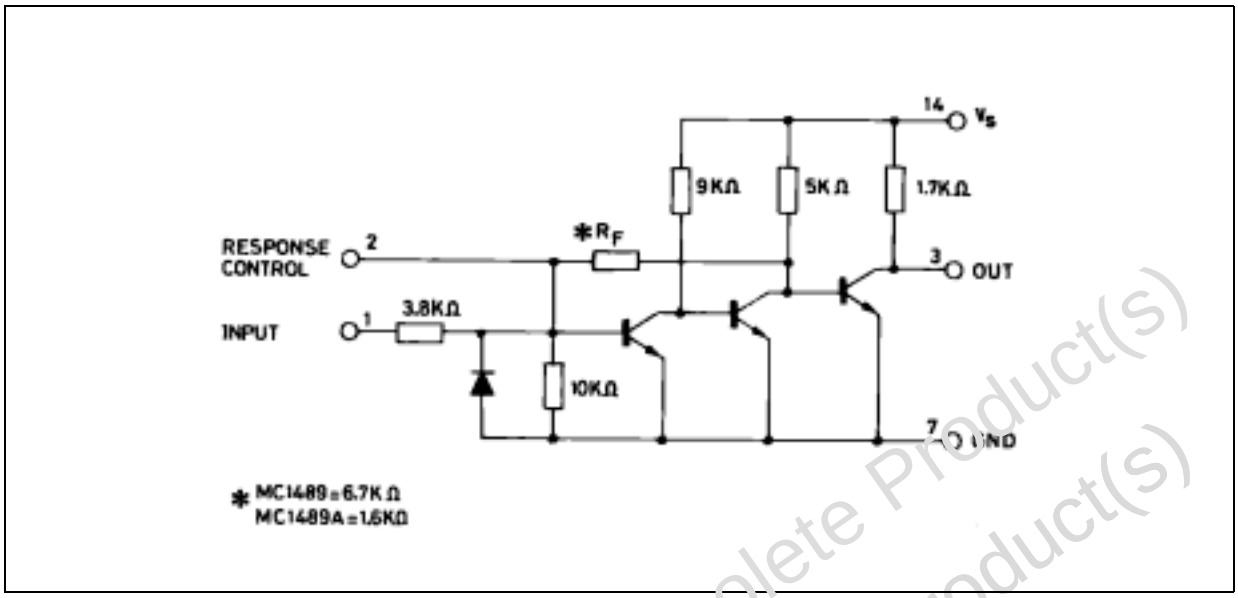
## Order code

| Part Number | |
|---|---|
| **DIP14** | **SO14 (Tape & reel)** |
| MC1489P | MC1489D1013TR |
| MC1489AP | MC1488AD1013TR |

# Contents

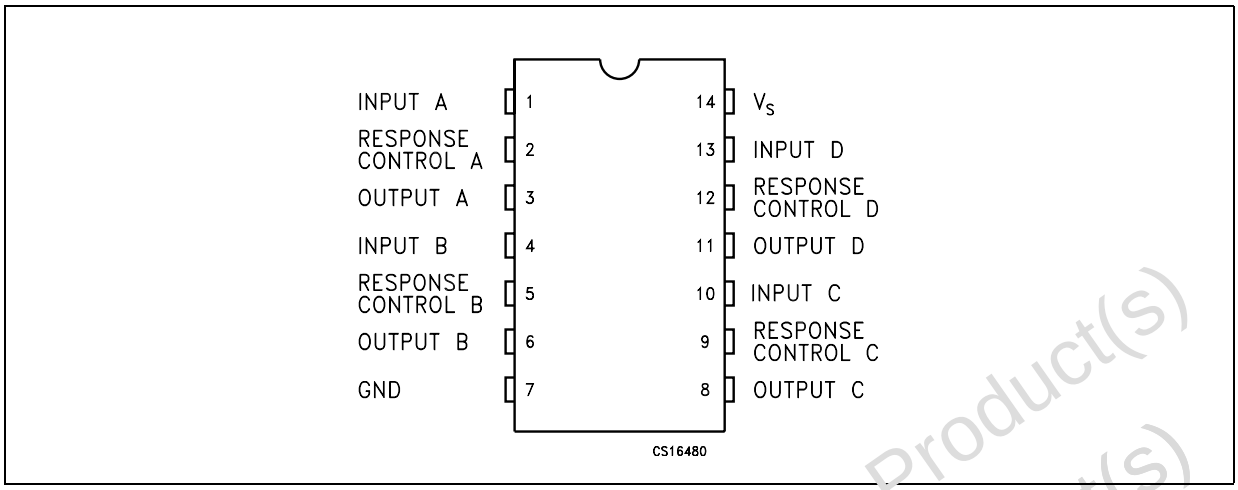
# 1 Diagram

**Figure 1. Schematic diagram**



# 2 Pin description

**Figure 2. Pin connections**



# 3 Maximum ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_S$ | Power supply voltage | 10 | V |
| $V_I$ | Input voltage range | ±30 | V |
| $I_{OL}$ | Output load current | 20 | mA |
| $P_{TOT}$ | Power dissipation | 1 | W |
| $T_{amb}$ | Operating ambient temperature | 0 to 75 | °C |
| $T_{stg}$ | Storage temperature range | -65 to 150 | °C |

*Note: Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.*

**Table 2. Thermal data**

| Symbol | Parameter | Plastic DIP14 | SO14 | Unit |
|---|---|---|---|---|
| $R_{thJA}$ | Thermal resistance junction-ambient Max | 200 | 165 | °C/W |

# 4 Electrical characteristics

**Table 3. Electrical characteristics** (Response control pin in open; $V_S$ = 5V, $T_{amb}$ = 0 to 75°C, unless otherwise specified)

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $I_{IH}$ | Positive input current | $V_{IH}$ = 25 V | | 3.6 | | 8.3 | mA |
| | | $V_{IH}$ = 3 V | | 0.43 | | | |
| $I_{IL}$ | Negative input current | $V_{IL}$ = - 25 V | | -3.6 | | -8.3 | mA |
| | | $V_{IL}$ = - 3 V | | -0.43 | | | |
| $V_{IH}$ | Input turn-on threshold voltage | $T_{amb}$ = 25°C, $V_{OL} \leq$ 0.45 V $I_L$ = 10 mA | for MC1489 | 1 | | 1.5 | V |
| | | | for MC1489A | 1.75 | 1.95 | 2.25 | |
| $V_{IL}$ | Input turn-off threshold voltage | $T_{amb}$ = 25°C, $V_{OL} \geq$ 2.5 V $I_L$ = -0.5 mA | | 0.75 | | 1.25 | V |
| $V_{OH}$ | Output voltage high | $V_{IH}$ = 0.75 V, $I_L$ = -0.5 mA | | 2.5 | 4 | 5 | V |
| | | $I_L$ = 0.5 mA Input Open Circuit | | 2.5 | 4 | 5 | |
| $V_{OL}$ | Output voltage low | $V_{IL}$ = 3 V, $I_L$ = 10 mA | | | 0.2 | 0.45 | V |
| $I_{OS}$ | Output short circuit current | | | | -3 | -4 | mA |
| $I_S$ | Power supply current | All gates "ON", $I_O$ = 0 mA, $V_{IH}$ = 5 V | | | 16 | 26 | mA |
| $P_C$ | Power consumption | $V_{IH}$ = 5 V | | | 80 | 130 | mW |

**Table 4. Switching characteristics** ($V_S$ = 5V, $T_{amb}$ = 25°C)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation delay time | $R_L$ = 3.9 KΩ | | 25 | 85 | ns |
| $t_{THL}$ | Rise time | $R_L$ = 3.9 KΩ | | 120 | 175 | ns |
| $t_{PHL}$ | Propagation delay time | $R_L$ = 390 Ω | | 25 | 50 | ns |
| $t_{THL}$ | Fall time | $R_L$ = 390 Ω | | 10 | 20 | ns |

# 5 Test circuit

**Figure 3. Switching response**

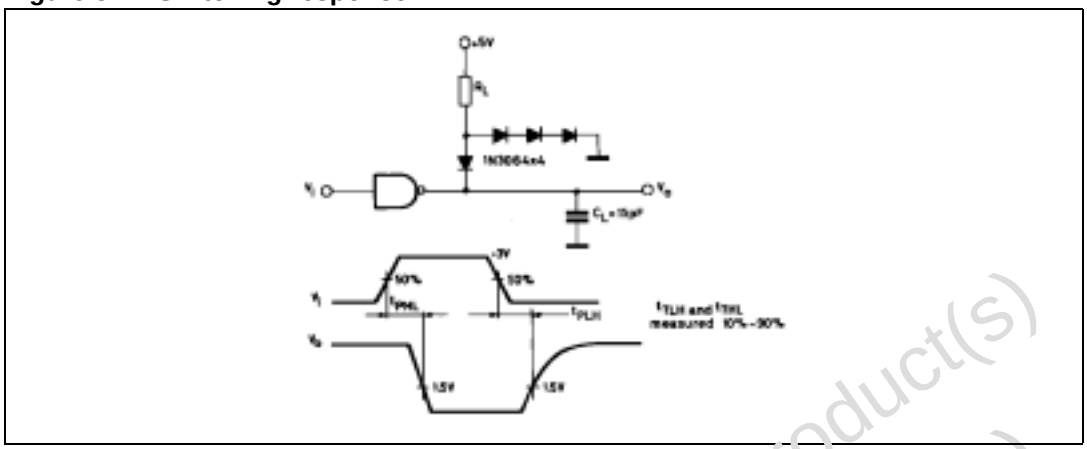
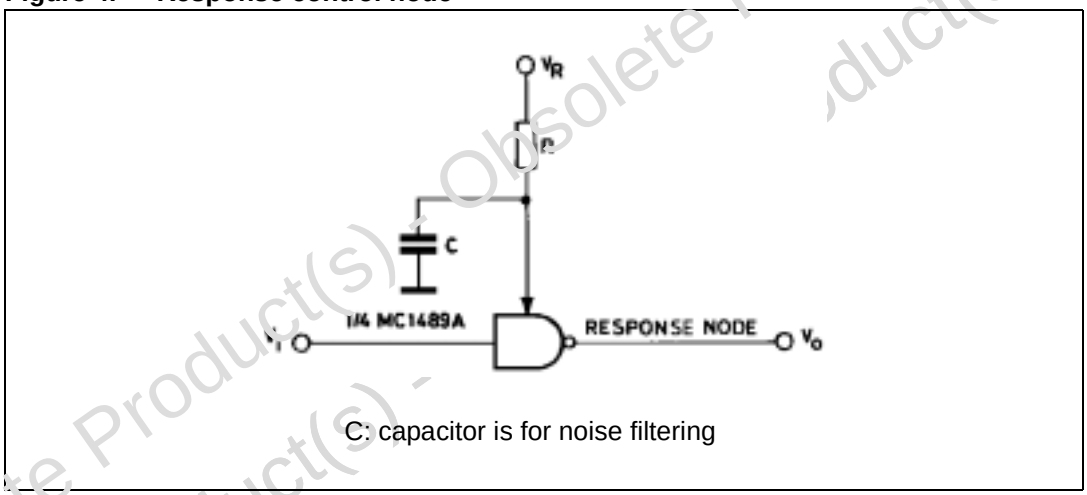


**Figure 4. Response control node**




C: capacitor is for noise filtering

**Figure 5. Input current**

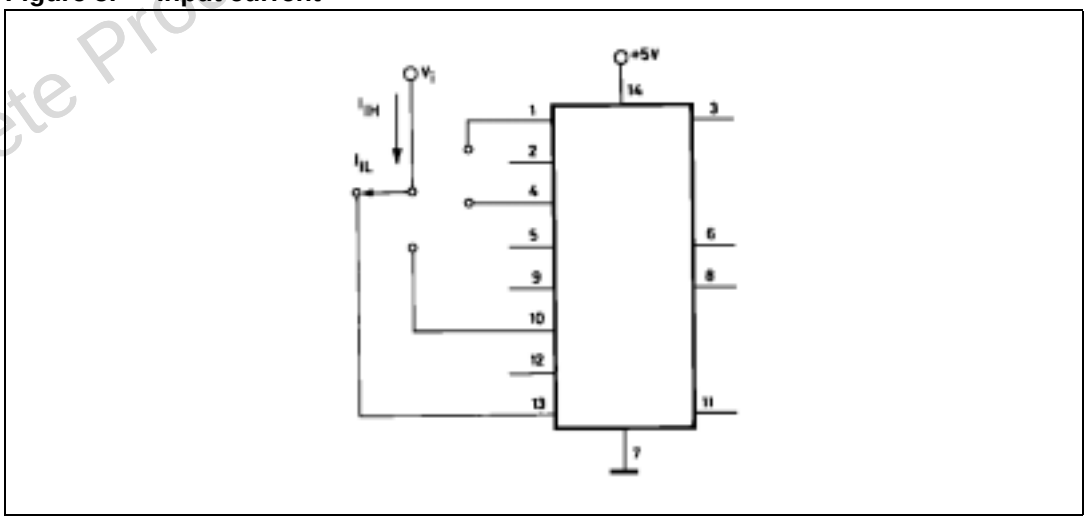


**Figure 6. Output short-circuit current**

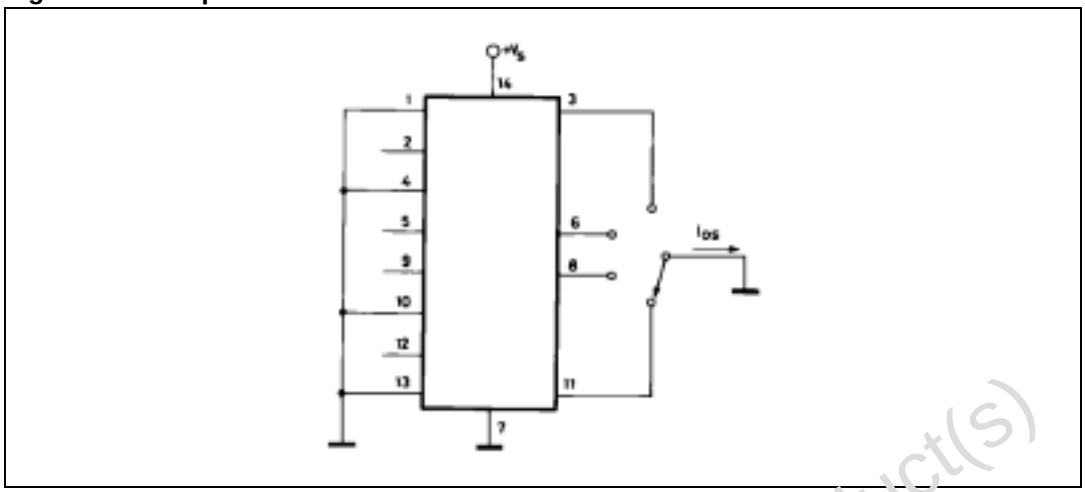



**Figure 7. Output voltage and input threshold voltage**

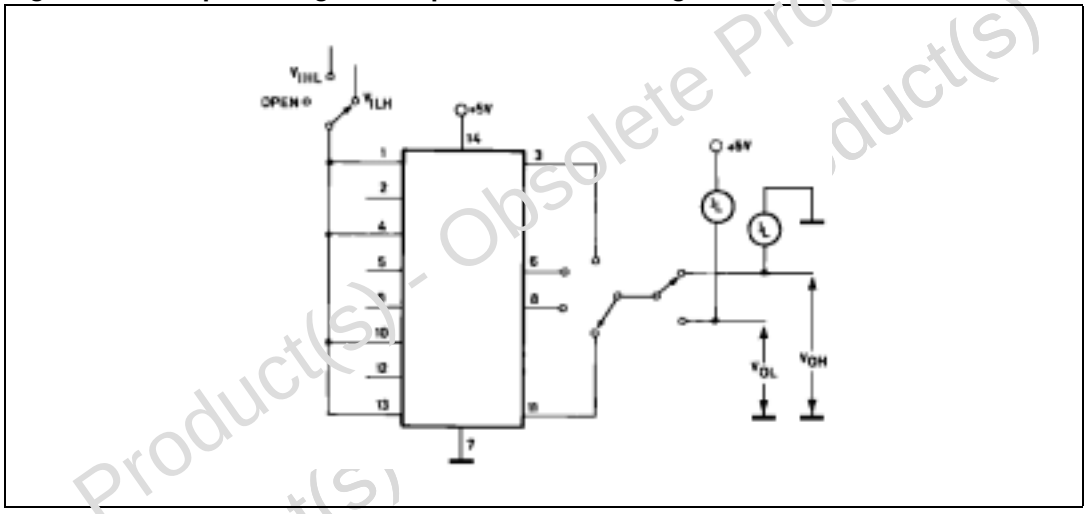
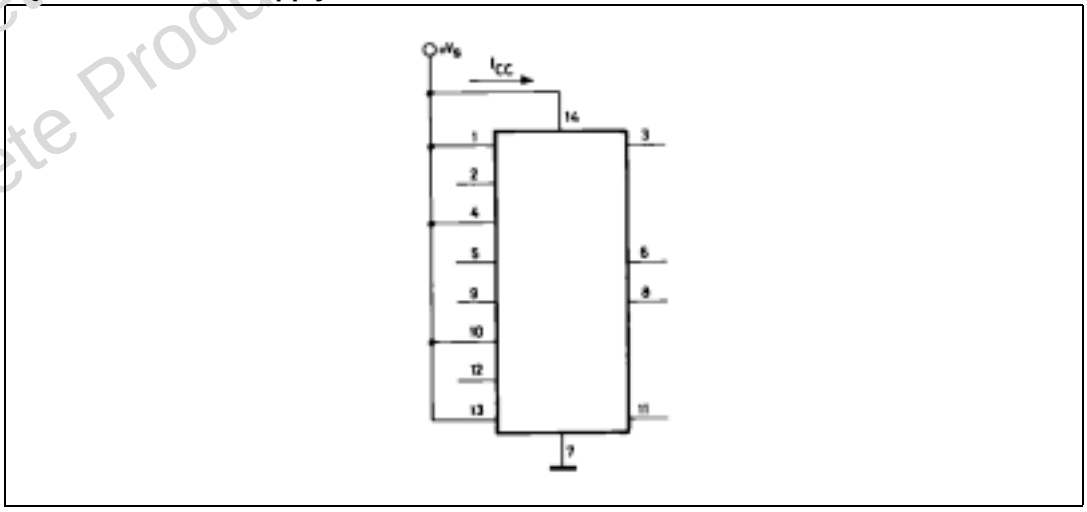
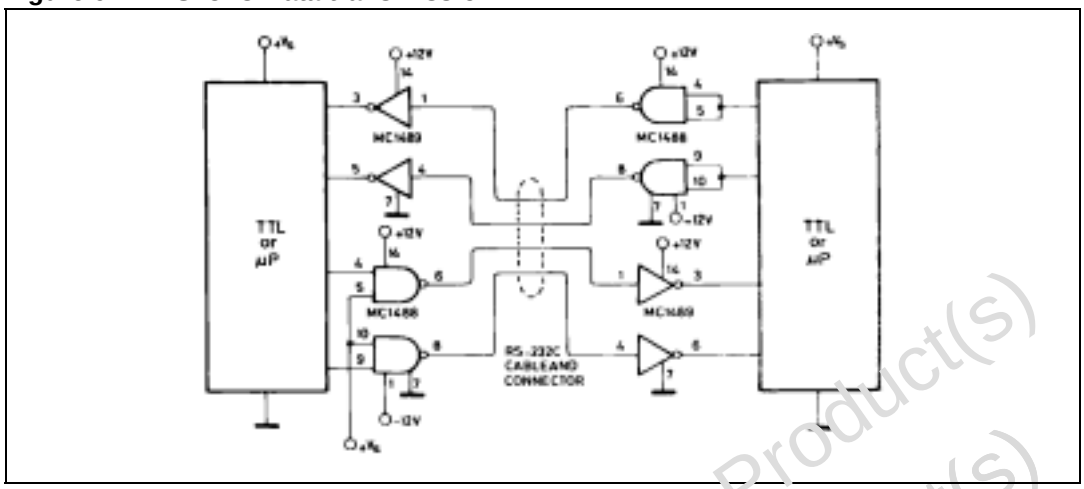



**Figure 8. Power supply currents**



# 6 Typical applications

**Figure 9. RS232C Data transmission**



# 7 Typical characteristics

($V_S$ = 5V, $T_{amb}$ = 25°C)

**Figure 10. Input current vs input voltage**

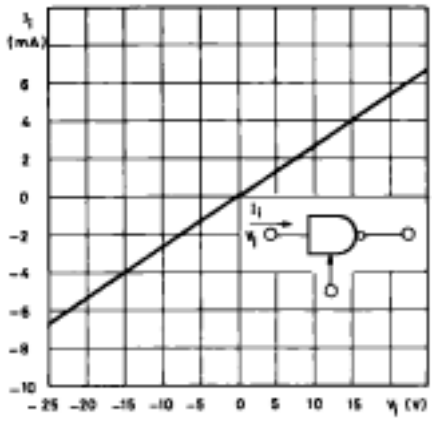



**Figure 11. MC1489 Input threshold voltage adjustment**

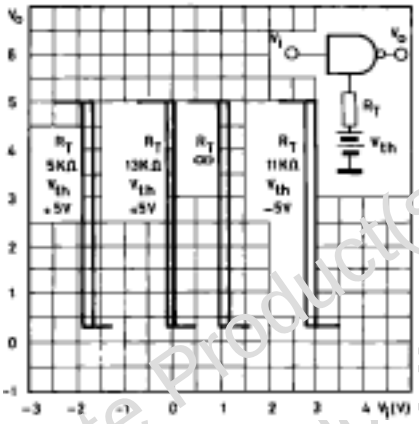



**Figure 12. MC1489A Input threshold voltage adjustment**

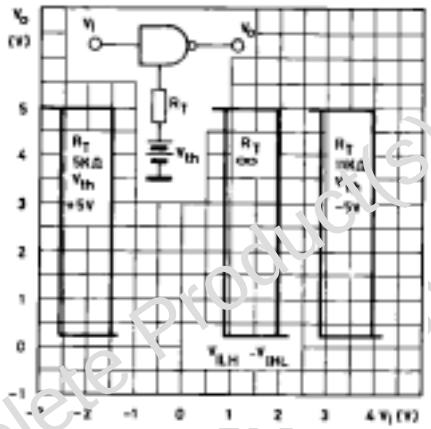



**Figure 13 Input threshold vs temperature**

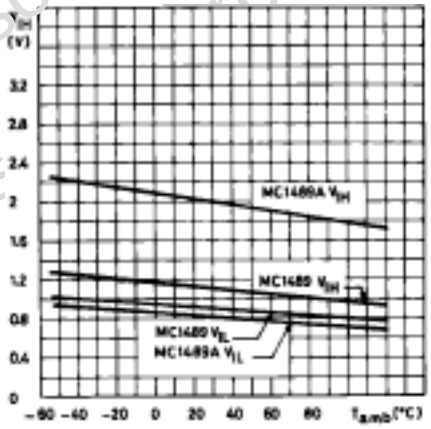
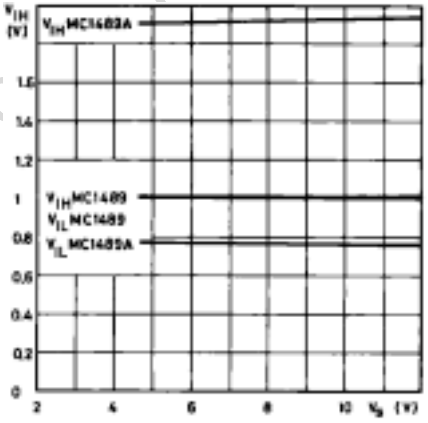



**Figure 14. Input threshold vs power supply voltage**



# 8 Application 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 MC1488 quad driver and its companion circuit, the MC1489 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 3000Ω and 7000Ω for input voltages between 3.0 and 25V in magnitude; and any voltage on the receiver input in an open circuit condition must be less than 2.0V in magnitude. The MC1489 circuits meet these requirements with a maximum open circuit voltage of one $V_{BE}$.

The receiver shall detect a voltage between - 3.0 and - 25V as a Logic "1" and inputs between + 3.0 and + 2.5V as a Logic "0". On some interchange leads, an open circuit of power "OFF" condition (300Ω or more to ground) shall be decoded as an "OFF" condition or Logic "1". For the 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.

## 8.1 Device characteristics

The MC1489 interface receivers have internal feedback from the second stage to the input stage providing input hysteresis for noise rejection. The MC1489 input has typical turn-on voltage of 1.25V and turn-off of 1.0 V for a typical hysteresis of 250mV. The MC1489A has typical turn-on of 1.95V and turn-off of 0.8V for typically 1.15V 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. *Figure 4.*, *Figure 6.* and *Figure 7.* illustrate the input threshold voltage shift possible through this technique.

This response node can also be used for the filtering of the high-frequency, high-energy noise pulses. *Figure 11.* and *Figure 12.* 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 may 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 13.*).

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 14.* where two receivers are slaved to the same line that must still meet the RS-232C impedance requirement.

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**Figure 15. Typical turn-on threshold vs capacitance from response control pin to GND**

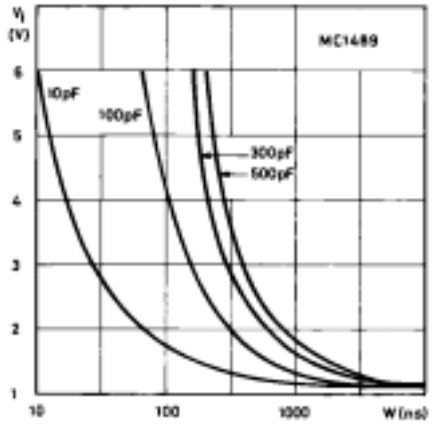



**Figure 16. Typical turn-on threshold vs capacitance from response control pin to GND**

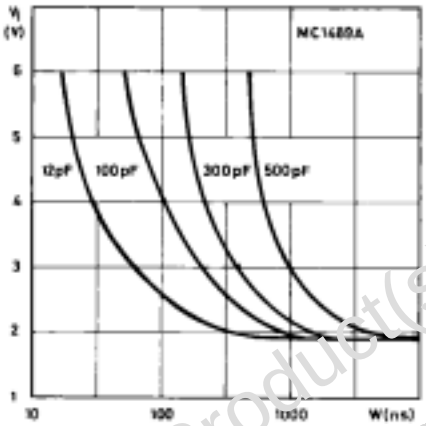
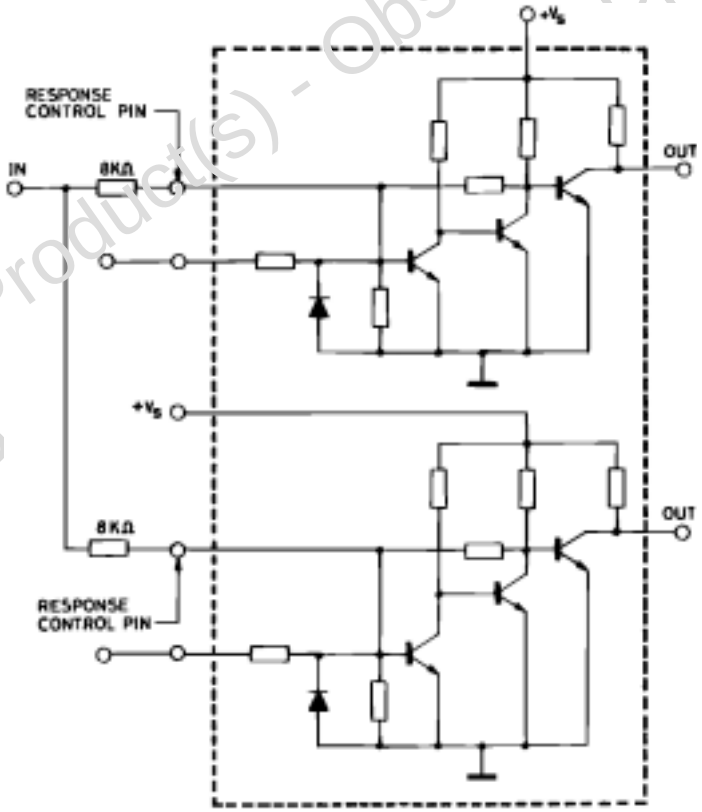
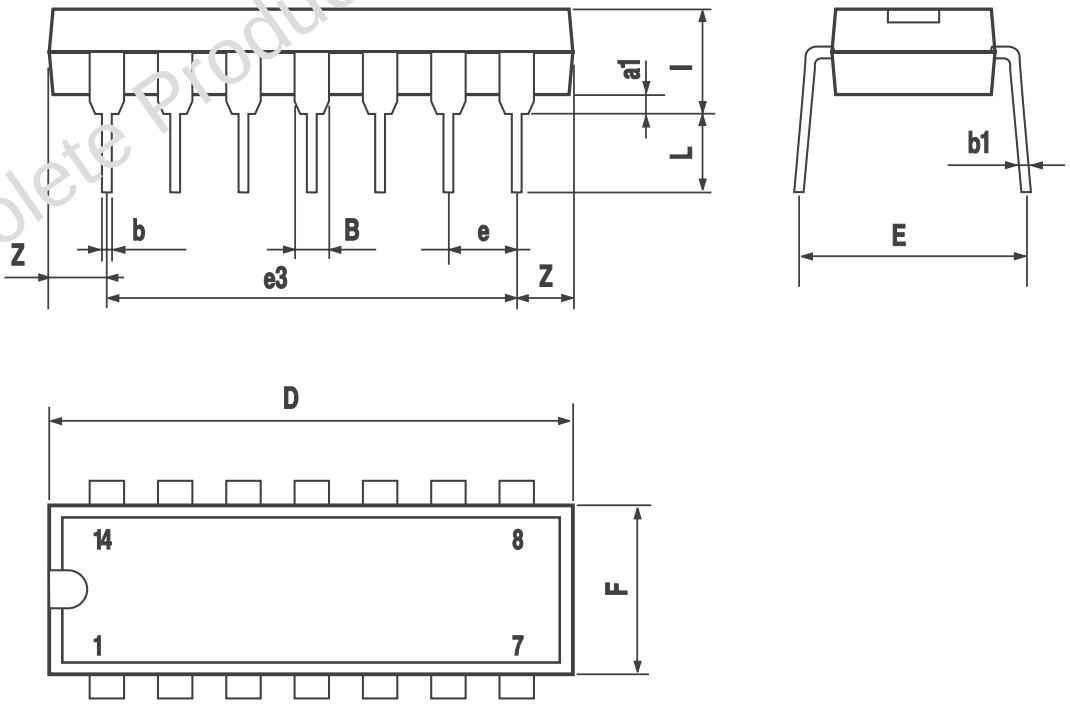



**Figure 17. Typical paralleling of two MC1489/A Receivers to meet RS-232C**



## Plastic DIP-14 MECHANICAL DATA

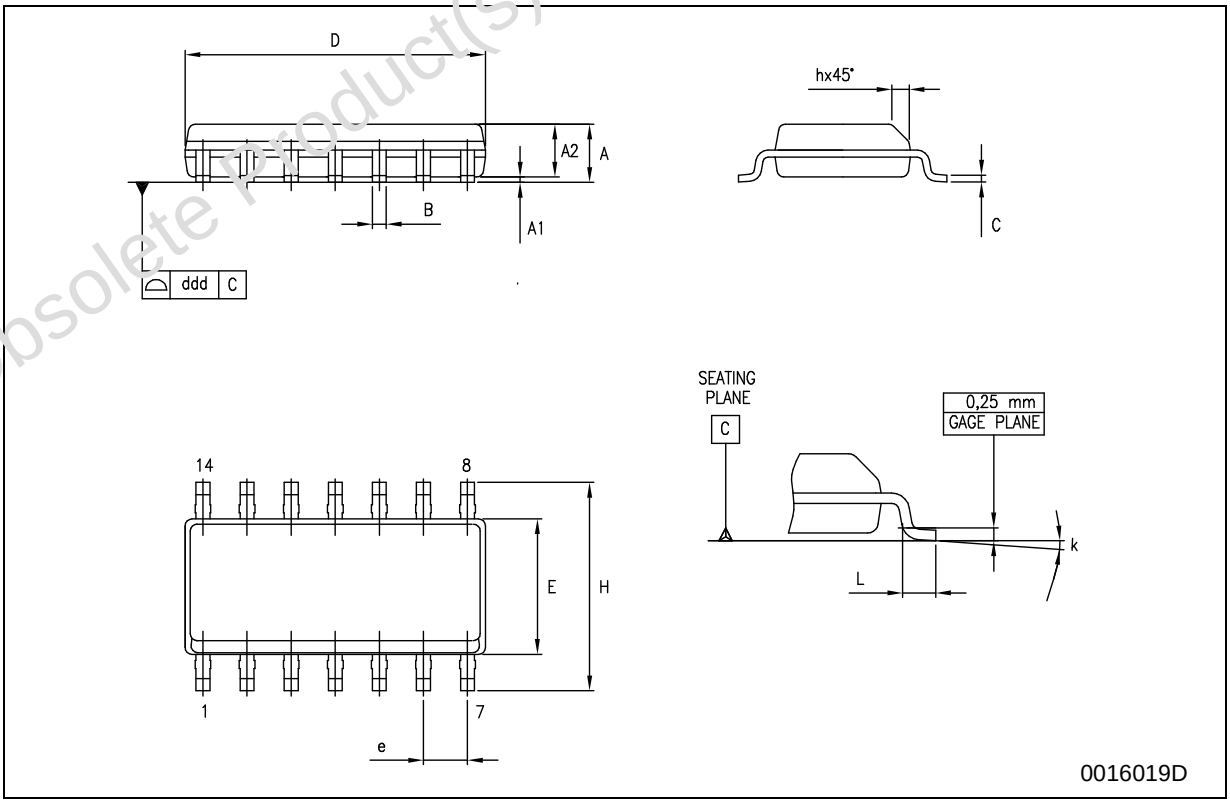
| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 15.24 | | | 0.600 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | 1.27 | | 2.54 | 0.050 | | 0.100 |




P001A

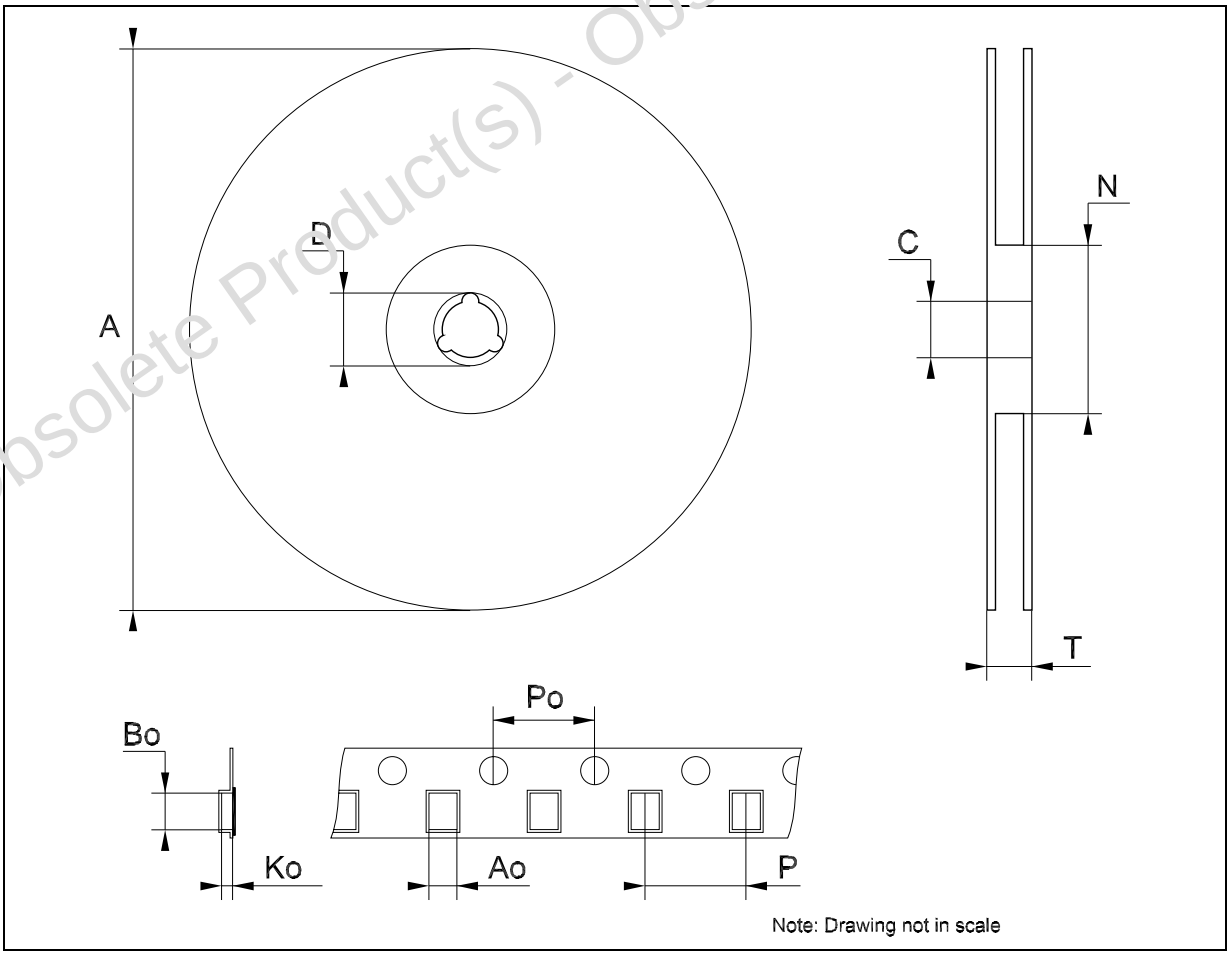
## SO-14 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 1.35 | | 1.75 | 0.053 | | 0.069 |
| A1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| A2 | 1.10 | | 1.65 | 0.043 | | 0.065 |
| B | 0.33 | | 0.51 | 0.013 | | 0.020 |
| C | 0.19 | | 0.25 | 0.007 | | 0.010 |
| D | 8.55 | | 8.75 | 0.337 | | 0.344 |
| E | 3.8 | | 4.0 | 0.150 | | 0.157 |
| e | | 1.27 | | | 0.050 | |
| H | 5.8 | | 6.2 | 0.228 | | 0.244 |
| h | 0.25 | | 0.50 | 0.010 | | 0.020 |
| L | 0.4 | | 1.27 | 0.016 | | 0.050 |
| k | 0° | | 8° | 0° | | 8° |
| ddd | | | 0.100 | | | 0.004 |



## Tape & Reel SO-14 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 330 | | | 12.992 |
| C | 12.8 | | 13.2 | 0.504 | | 0.519 |
| D | 20.2 | | | 0.795 | | |
| N | 60 | | | 2.362 | | |
| T | | | 22.4 | | | 0.882 |
| Ao | 6.4 | | 6.6 | 0.252 | | 0.260 |
| Bo | 9 | | 9.2 | 0.354 | | 0.362 |
| Ko | 2.1 | | 2.3 | 0.082 | | 0.090 |
| Po | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 7.9 | | 8.1 | 0.311 | | 0.319 |




Note: Drawing not in scale

# 9 Revision history

**Table 5. Revision history**

| Date | Revision | Changes |
|---|---|---|
| 13-Apr-2006 | 4 | Order codes has been updated and new template. |