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**Quad line receivers**

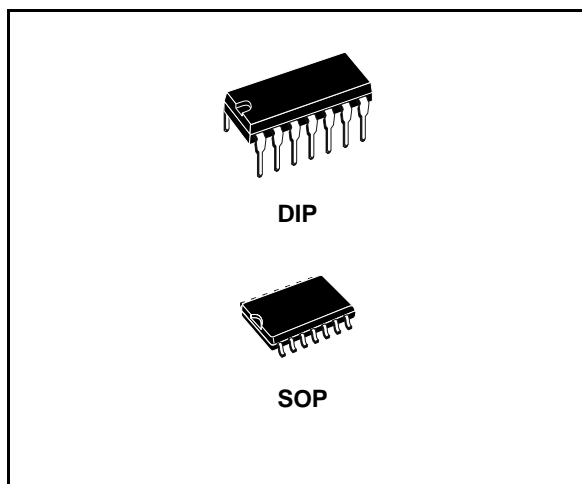
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**General features**

- Input resistance  $-3k$  to  $7k\Omega$
- Input signal range  $\pm 30V$
- Input threshold hysteresis built-in
- Response control:
  - a) Logic threshold shifting
  - b) Input noise filtering

**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	
<b>DIP14</b>	<b>SO14 (Tape &amp; reel)</b>
MC1489P	MC1489D1013TR
MC1489AP	MC1488AD1013TR

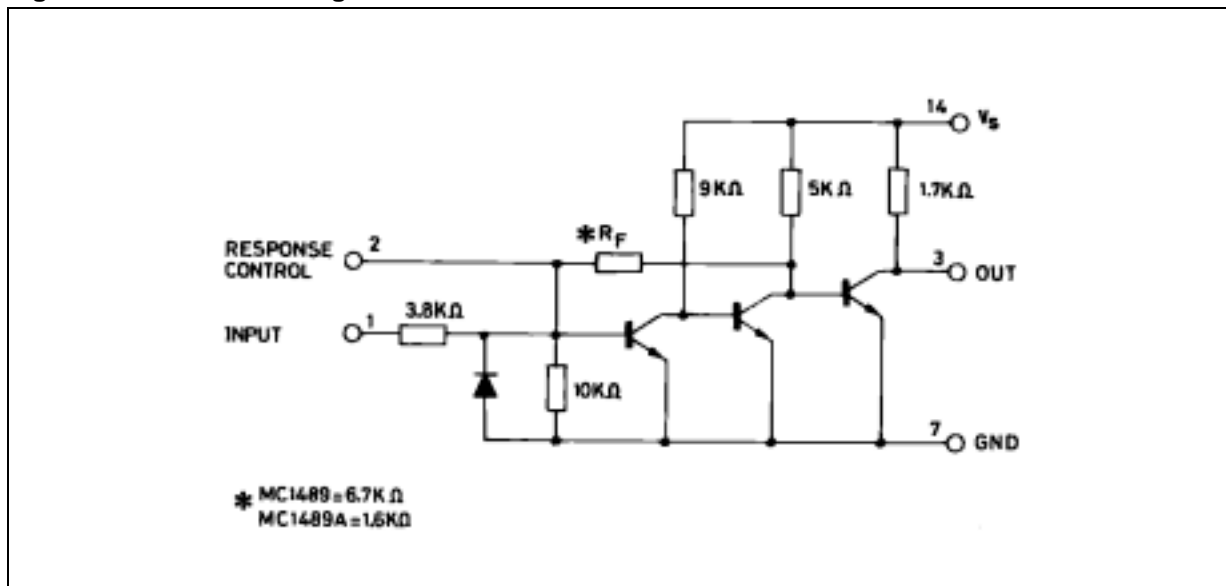
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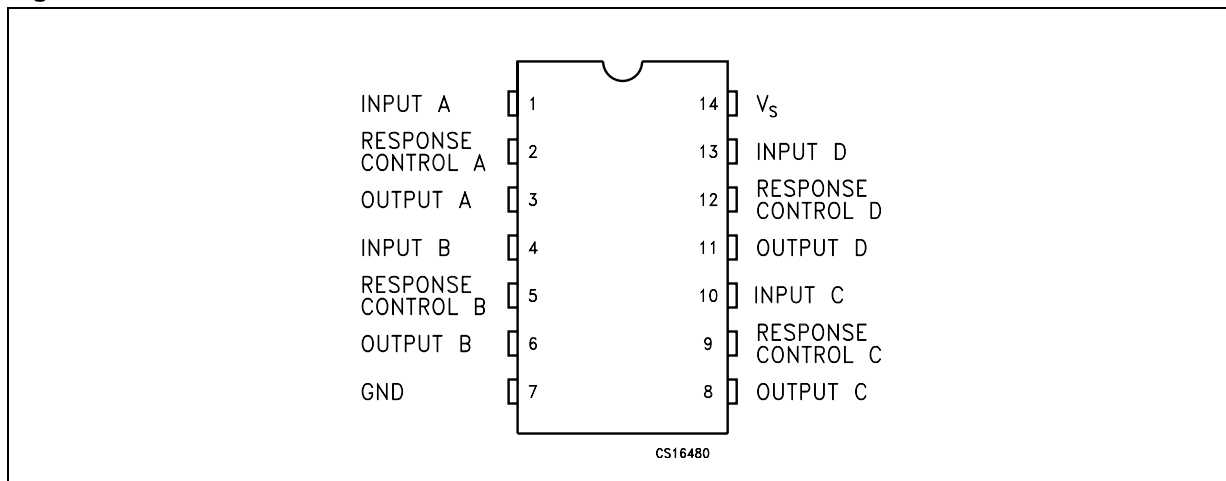
# 1 Diagram

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	$\pm 30$	V
$I_{OL}$	Output load current	20	mA
$P_{TOT}$	Power dissipation	1	W
$T_{amb}$	Operating ambient temperature	0 to 75	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature range	-65 to 150	$^{\circ}\text{C}$

*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	$^{\circ}\text{C}/\text{W}$

## 4 Electrical characteristics

**Table 3. Electrical characteristics** (Response control pin in open;  $V_S = 5V$ ,  $T_{amb} = 0$  to  $75^\circ C$ , 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	$T_{amb} = 25^\circ C$ , $V_{OL} \leq 0.45 V$ $I_L = 10 mA$	for MC1489	1		1.5	V
			for MC1489A	1.75	1.95	2.25	
$V_{IL}$	Input turn-off threshold voltage	$T_{amb} = 25^\circ C$ , $V_{OL} \geq 2.5 V$ $I_L = -0.5 mA$	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** ( $V_S = 5V$ ,  $T_{amb} = 25^\circ C$ )

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

# 5 Test circuit

Figure 3. Switching response

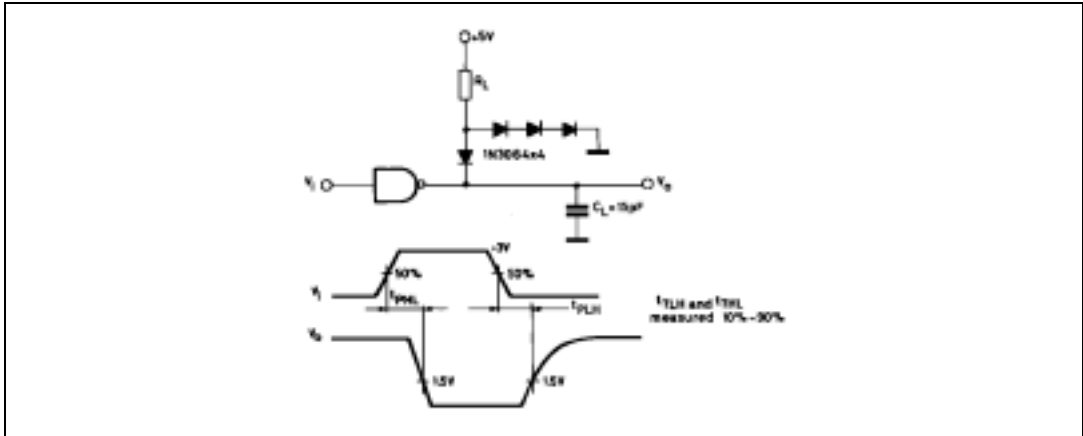


Figure 4. Response control node

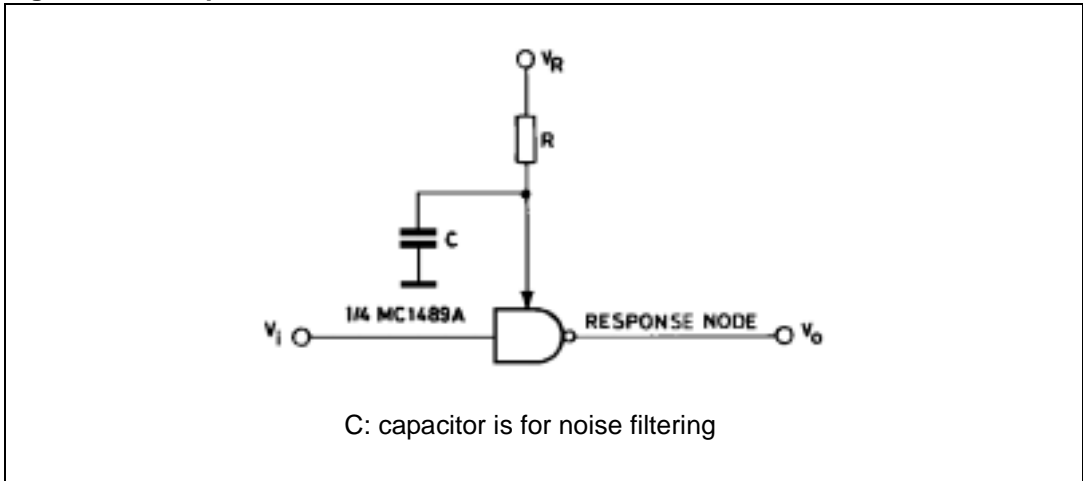


Figure 5. Input current

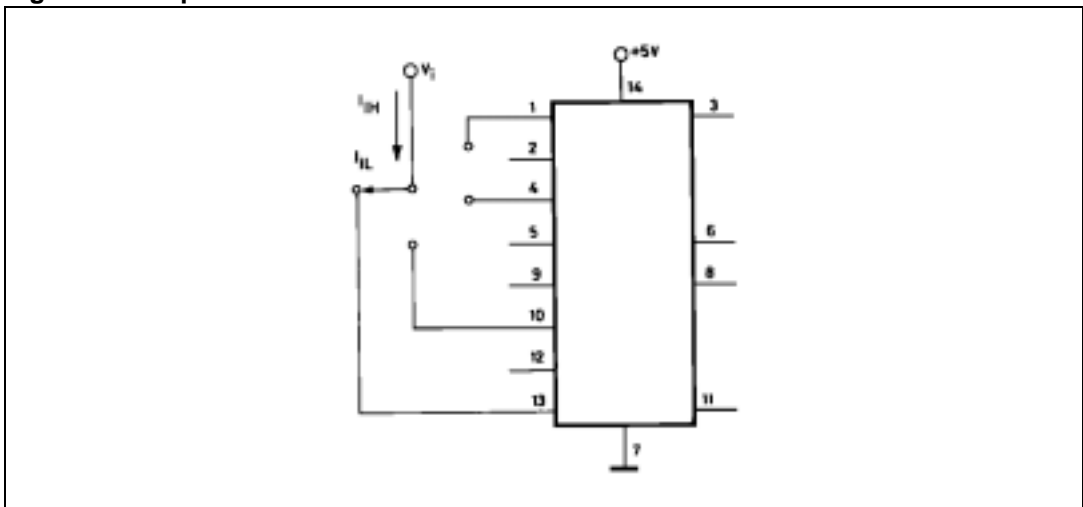


Figure 6. Output short-circuit current

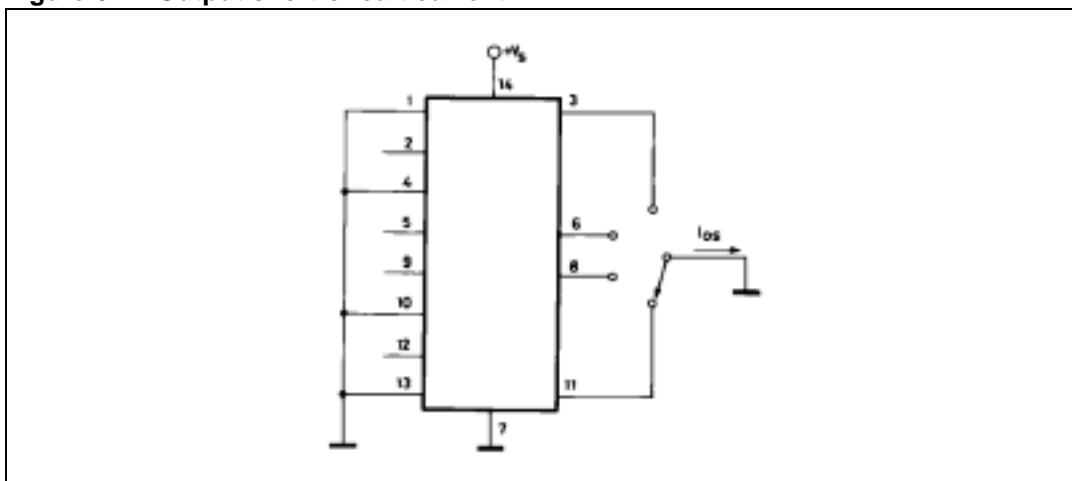


Figure 7. Output voltage and input threshold voltage

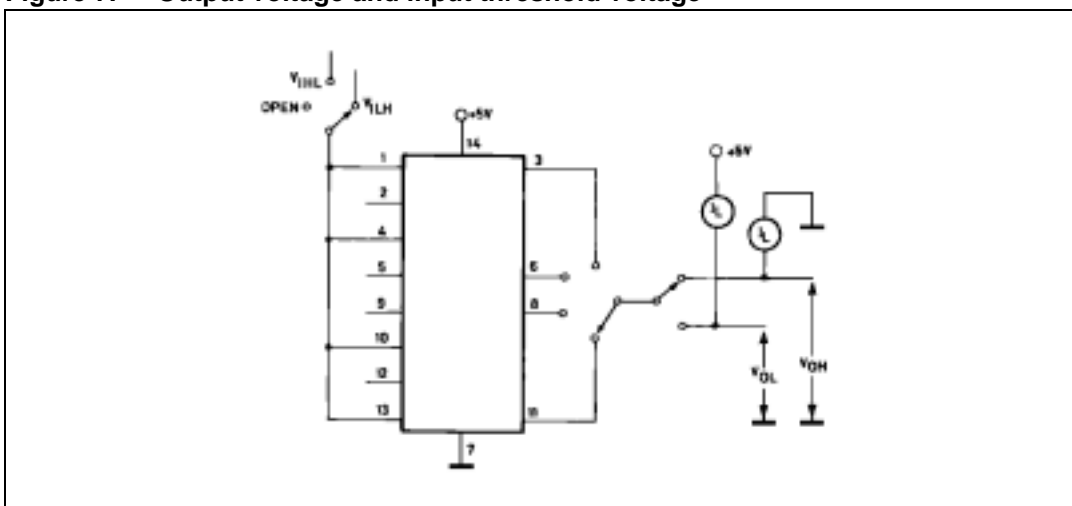
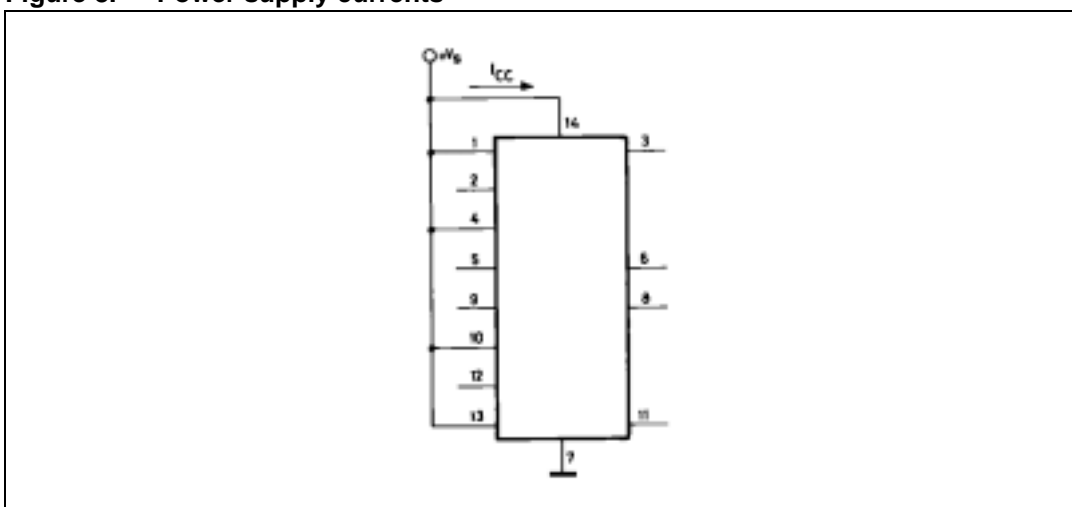


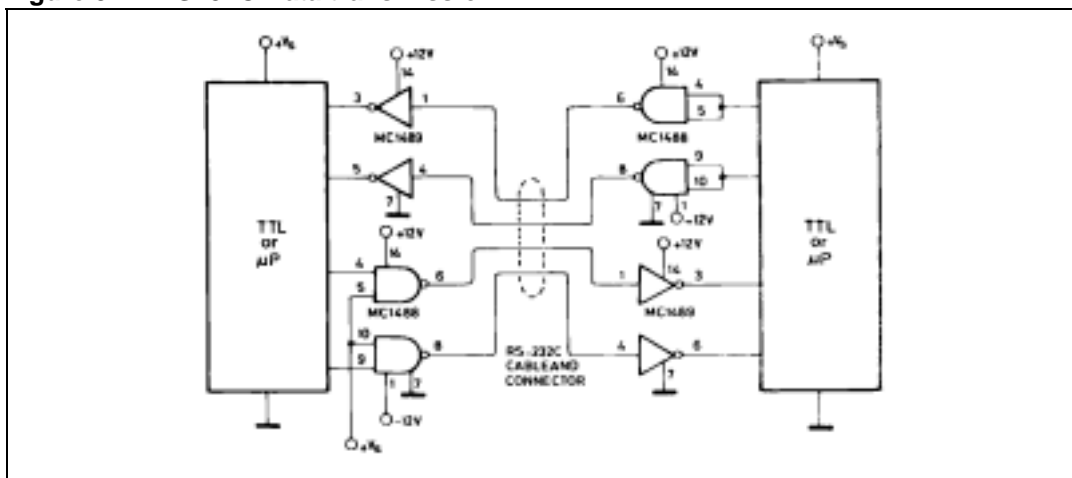
Figure 8. Power supply currents





## 6 Typical applications

Figure 9. RS232C Data transmission



# 7 Typical characteristics

( $V_S = 5V, T_{amb} = 25^\circ C$ )

Figure 10. Input current vs input voltage

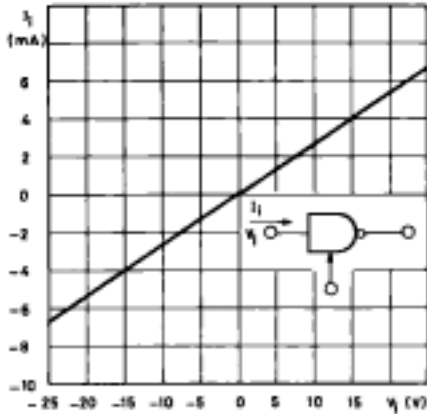


Figure 11. MC1489 Input threshold voltage adjustment

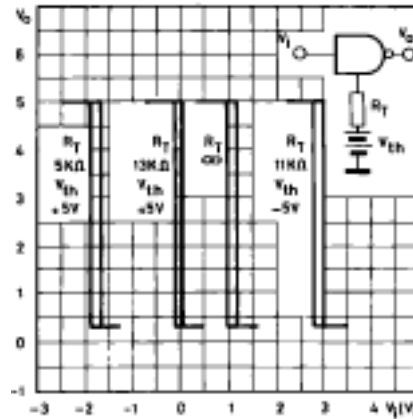


Figure 12. MC1489A Input threshold voltage adjustment

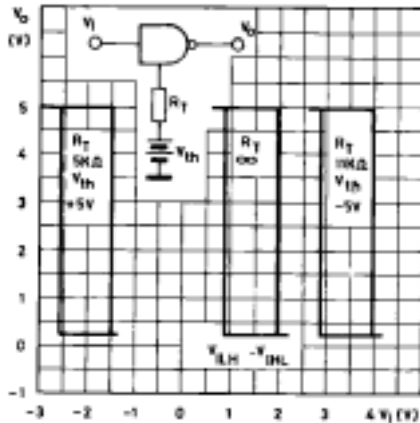


Figure 13. Input threshold vs temperature

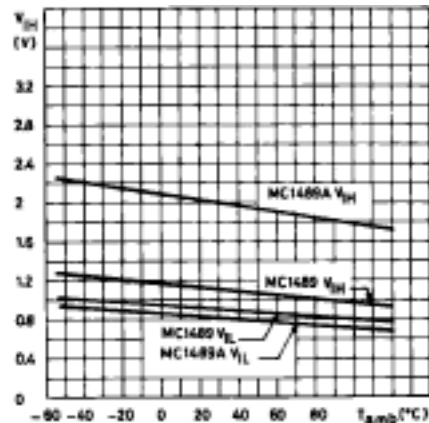
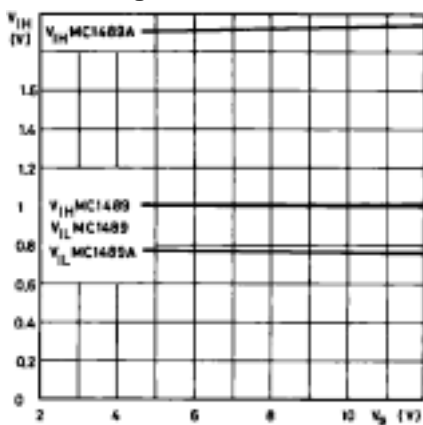


Figure 14. Input threshold vs power supply voltage



## 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  $3000\Omega$  and  $7000\Omega$  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 ( $300\Omega$  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 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 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

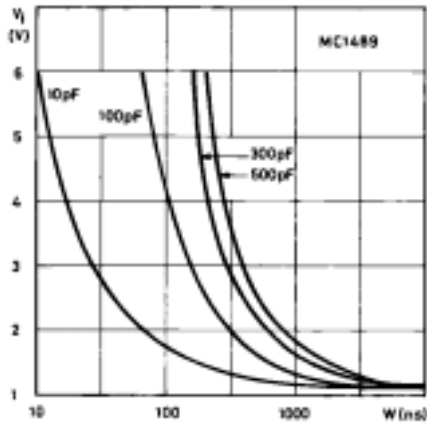


Figure 16. Typical turn-on threshold vs capacitance from response control pin to GND

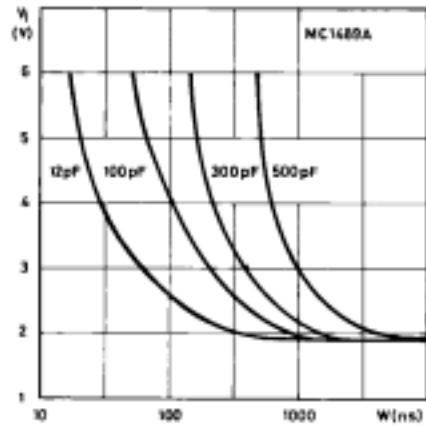
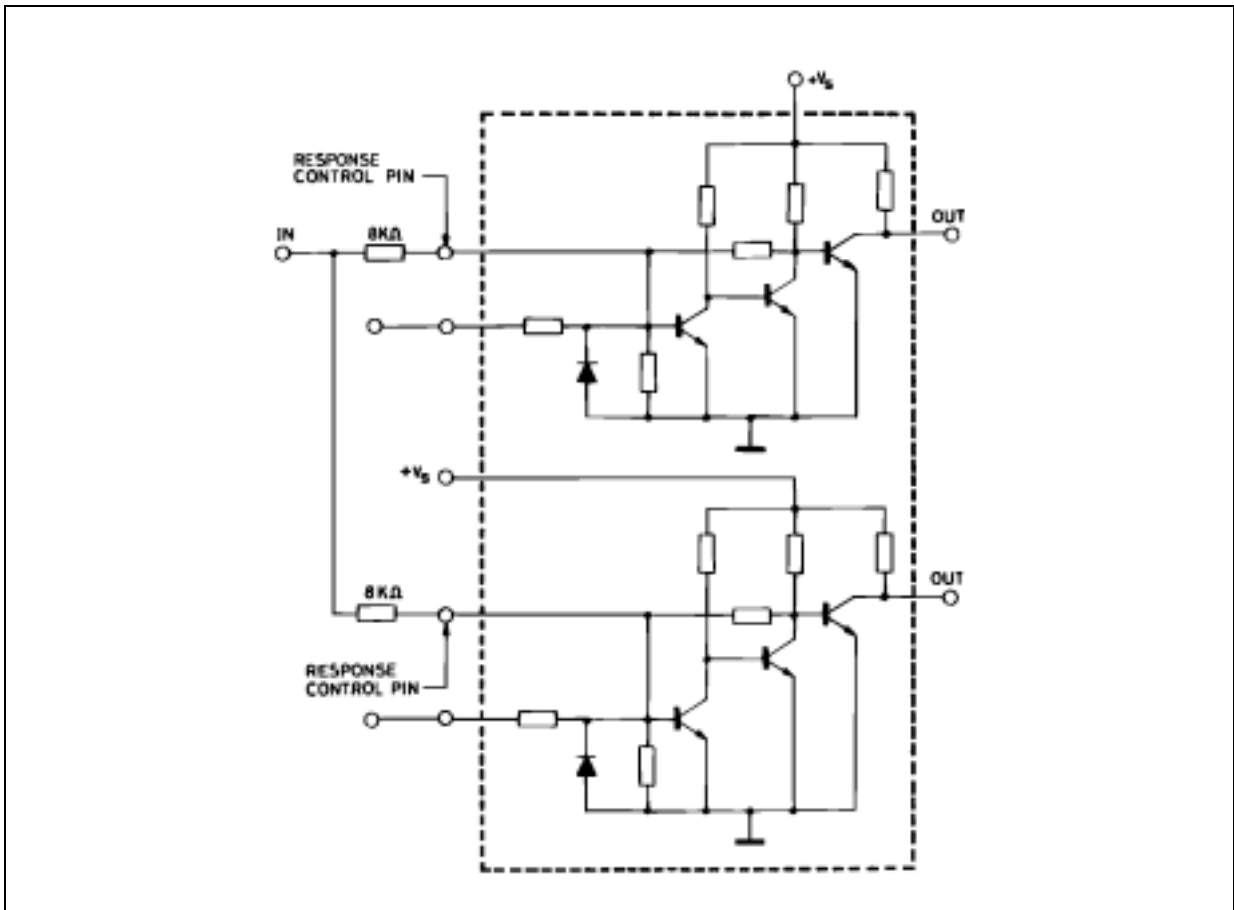
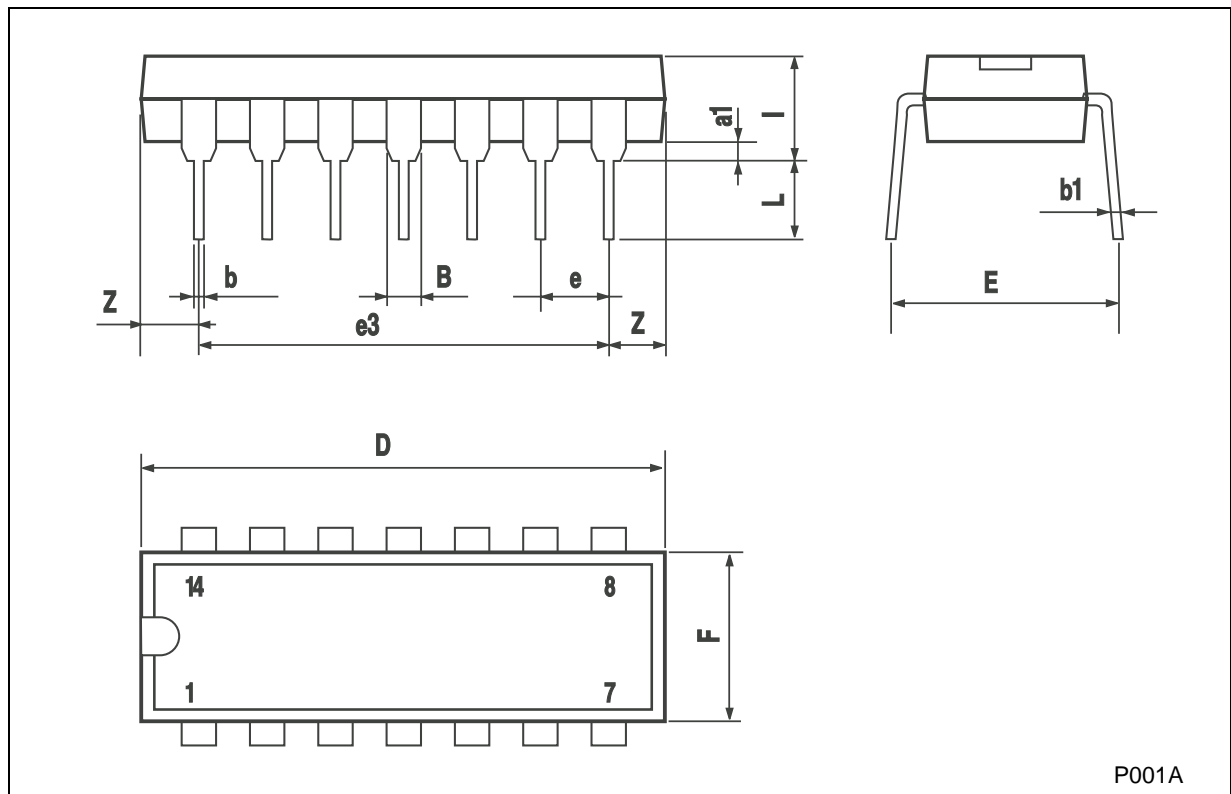


Figure 17. Typical paralleling of two MC1489/A Receivers to meet RS-232C



**Plastic DIP-14 MECHANICAL DATA**

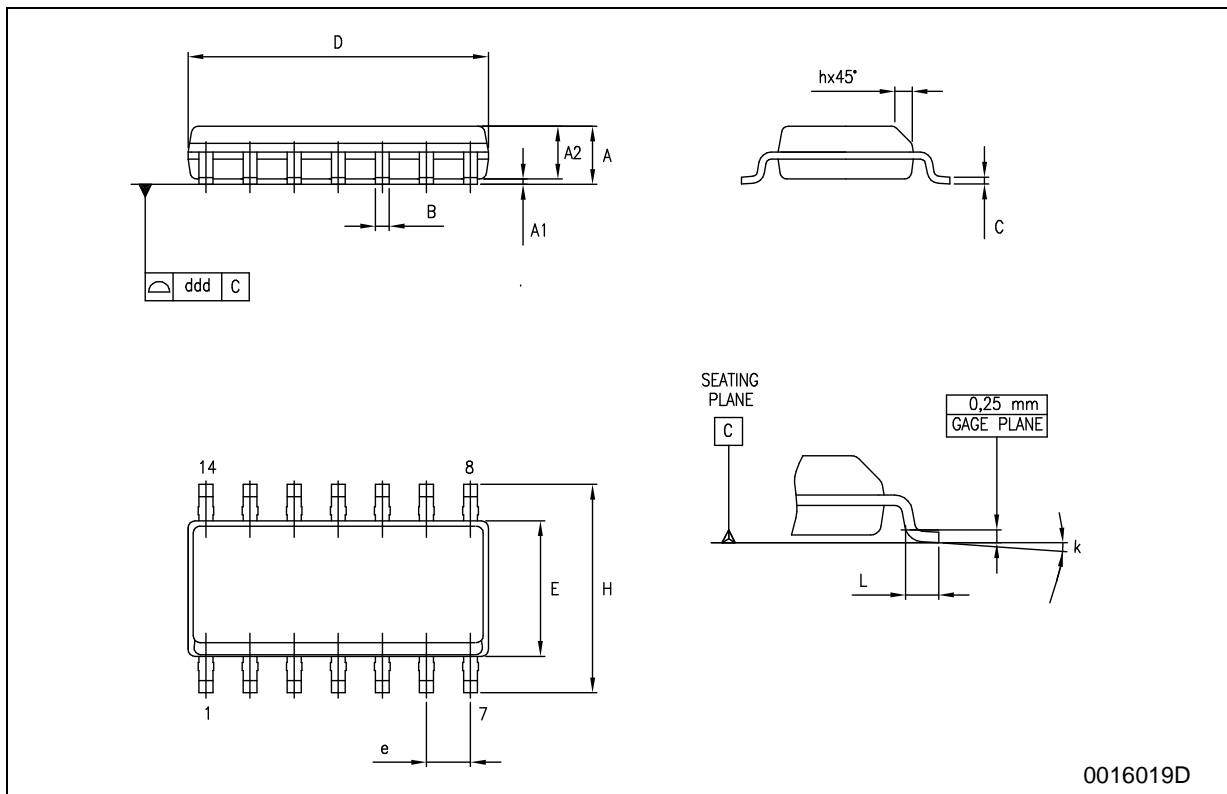
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100



P001A

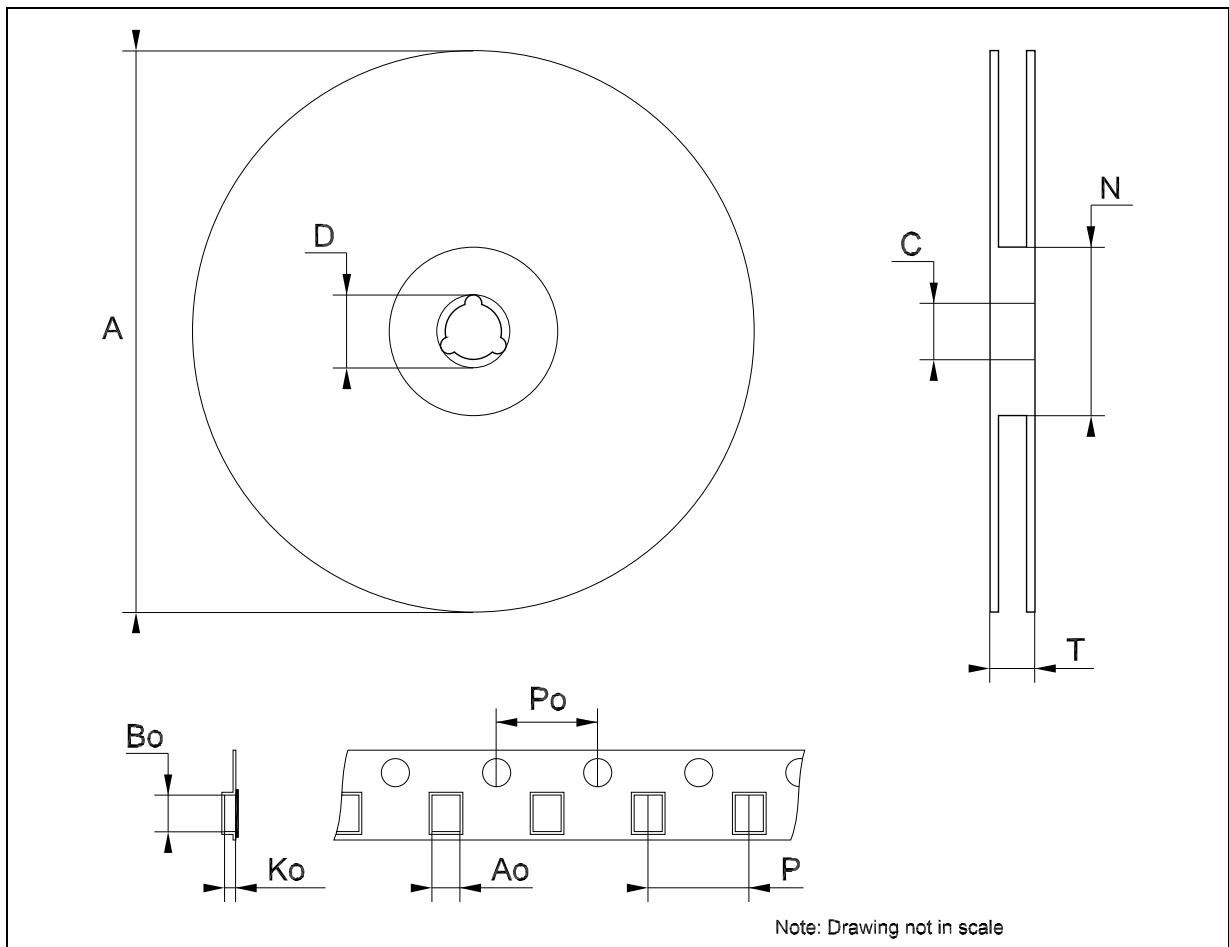
**SO-14 MECHANICAL DATA**

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



## 9 Revision history

Table 5. Revision history

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



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