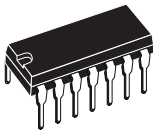
MC1488

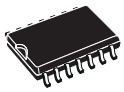
RS-232 quad line driver

General features

- Current limited output ±10mA typ.
- Power-off source impedance 300Ω min.
- Simple slew rate control with external capacitor
- Flexible operating supply range
- Inputs are TTL and µP compatible



DIP



SOP

Description

The MC1488 is a monolithic quad line driver designed to interface data terminal equipment with data communications equipment in conformance with the specifications of EIA Standard N° RS232C.

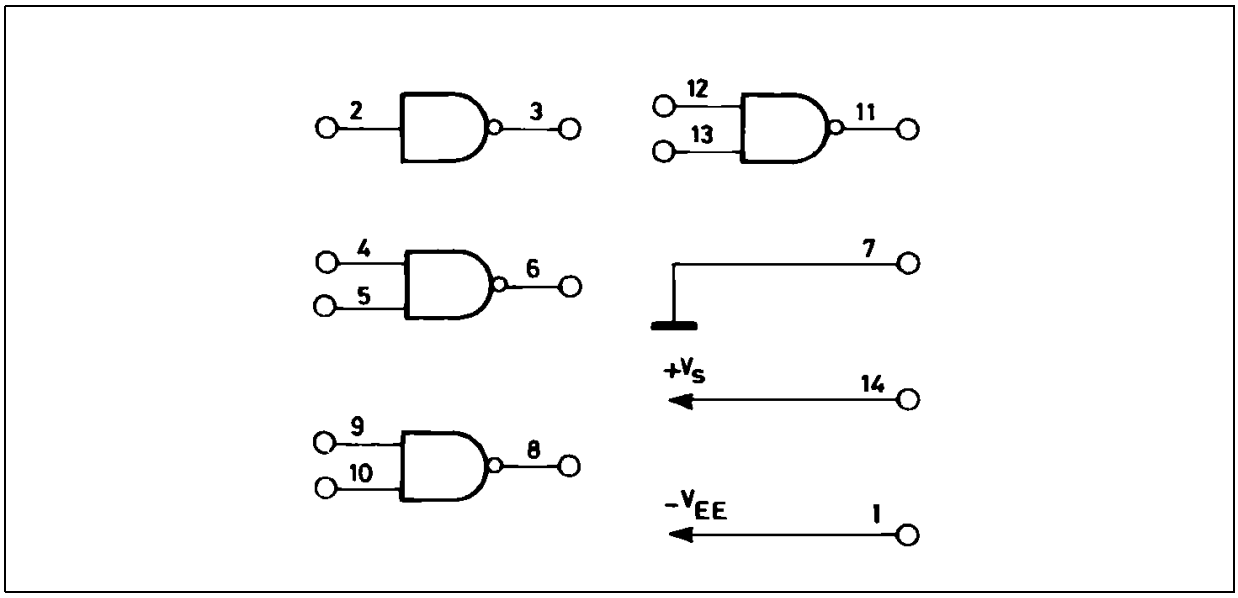
Order codes

DIP14	SO14 (Tape & reel)
MC1488P	MC1488D1013TR

Contents

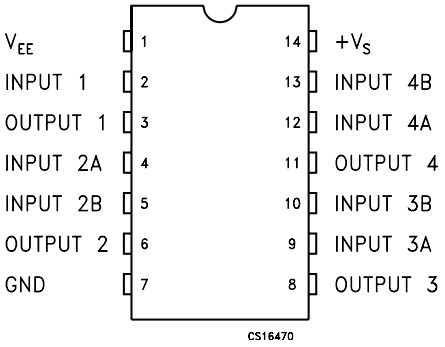
1 Diagram

Figure 1. Logic 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	15	V
V_{EE}	Power supply voltage	-15	V
V_{IR}	Input voltage range	V_{IR} = -15 to 7	V
V_O	Output signal voltage	±15	V
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 (V_S = 9V ± 10%, V_{EE} = -9V ± 10%, T_{amb} = 0 to 75°C, unless otherwise specified)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
I_{IL}	Input Current *Figure 3*	Low Logic State V_{IL} = 0 V			1	1.6	mA
I_{IH}	Input Current *Figure 3*	High Logic State V_{IH} = 5 V				10	µA
V_{OH}	Output Voltage *Figure 4*	High Logic State R_L = 3K,Ω V_{IL} = 0.8 V	V_S = 9V, V_{EE} = -9V	6	7		V
			V_S = 13V, V_{EE} = -13V	9	10.5		
V_{OL}	Output Voltage *Figure 4*	Low Logic State V_{IH} = 1.9 V	V_S = -9V, V_{EE} = 9V	-6	-7		V
			V_{EE} = -13.2V, V_S=13.2V	-9	-10.5		
$I_{OS}^{+(1)}$	Positive Output Short-Circuit Current *Figure 5*			6	10	12	mA
$I_{OS}^{-(1)}$	Negative Output Short-Circuit Current *Figure 5*			-6	-10	-12	mA
R_O	Output Resistance *Figure 6*	V_S = V_{EE} = 0, V_{OL} = ± 2V		300			Ω
I_S	Positive Supply Current (R_l = ∞) *Figure 7*	V_{IH} = 1.9 V, V_S = 9 V			15	20	mA
		V_{IL} = 0.8 V, V_S = 9 V			4.5	6	
		V_{IH} = 1.9 V, V_S = 12 V			19	25	
		V_{IL} = 0.8 V, V_S = 12 V			5.5	7	
		V_{IH} = 1.9 V, V_S = 15 V				34	
		V_{IL} = 0.8 V, V_S = 15 V				12	
I_{EE}	Negative Supply Current (R_L = ∞) *Figure 7*	V_{IH} = 1.9 V, V_S = -9 V			-13	-17	mA
		V_{IL} = 0.8 V, V_S = -9 V				-15	µA
		V_{IH} = 1.9 V, V_S = -12 V			-18	-23	mA
		V_{IL} = 0.8 V, V_S = -12 V				-15	µA
		V_{IH} = 1.9 V, V_S = -15 V				-34	mA
		V_{IL} = 0.8 V, V_S = -15 V				-2.5	
P_C	Power Consumption	V_S = 9 V, V_{EE} = -9 V				333	mW
		V_S = 12 V, V_{EE} = -12 V				567	

1. Maximum package power dissipation may be exceeded if all outputs are shorted simultaneously.

Table 4. Switching characteristics (V_S = 9 ± 1V, V_{EE} = -9 ± 1V, T_{amb} = 25°C)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_{PHL}	Propagation Delay Time *Figure 8*	Z_I = 3 KΩ and 15 pF		275	350	ns
t_{THL}	Fall Time *Figure 7*	Z_I = 3 KΩ and 15 pF		45	75	ns
t_{PHL}	Propagation Delay Time *Figure 8*	Z_I = 3 KΩ and 15 pF		110	175	ns
t_{THL}	Fall Time *Figure 8*	Z_I = 3 KΩ and 15 pF		55	100	ns

5 Test circuit

Figure 3. Input current

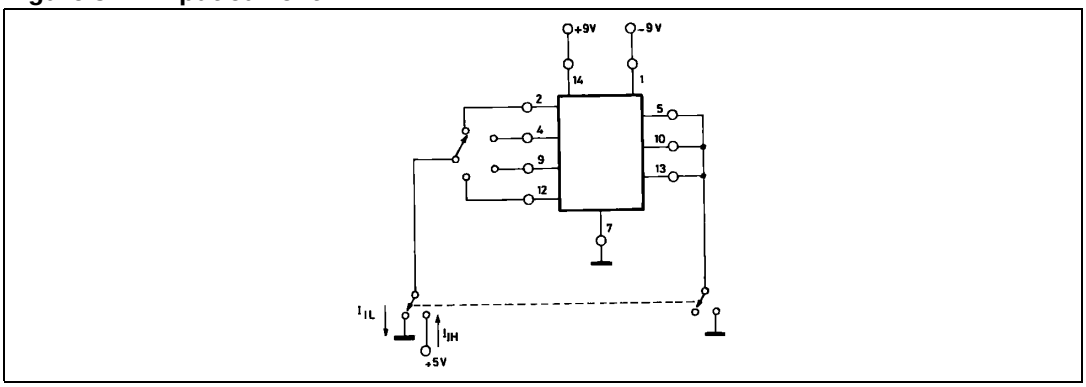


Figure 4. Output voltage

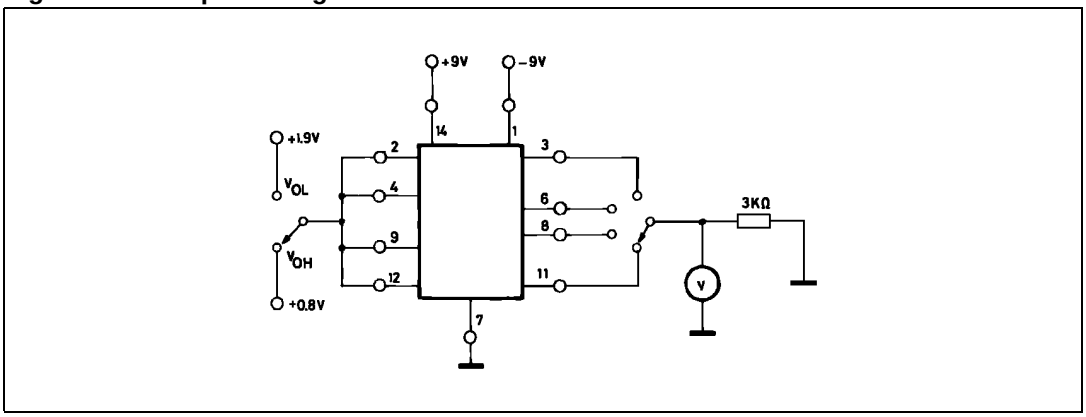


Figure 5. Output short-circuit current

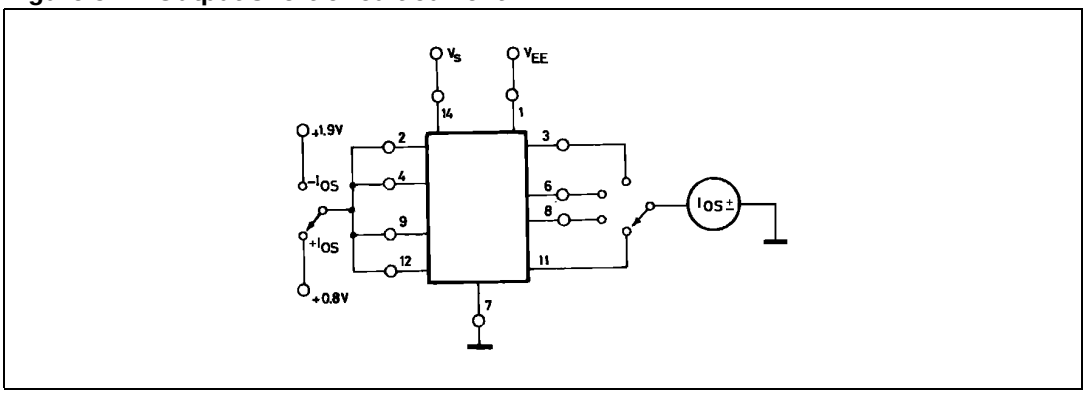


Figure 6. Output resistance (power off)

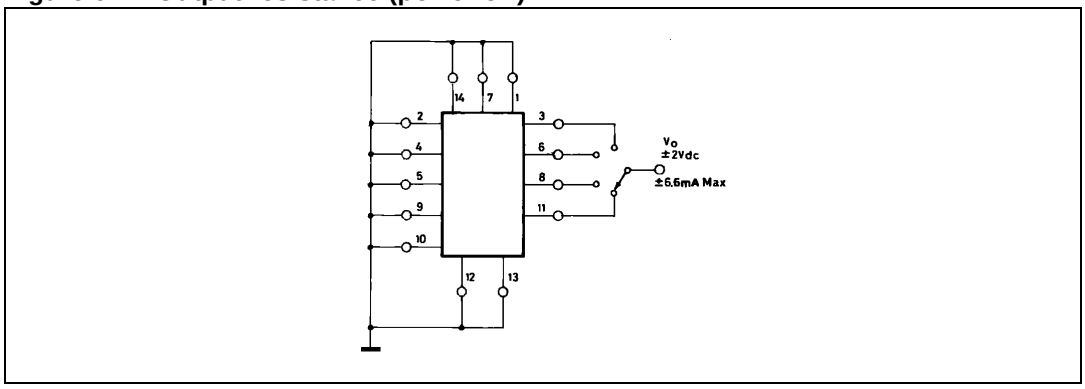


Figure 7. Power supply currents

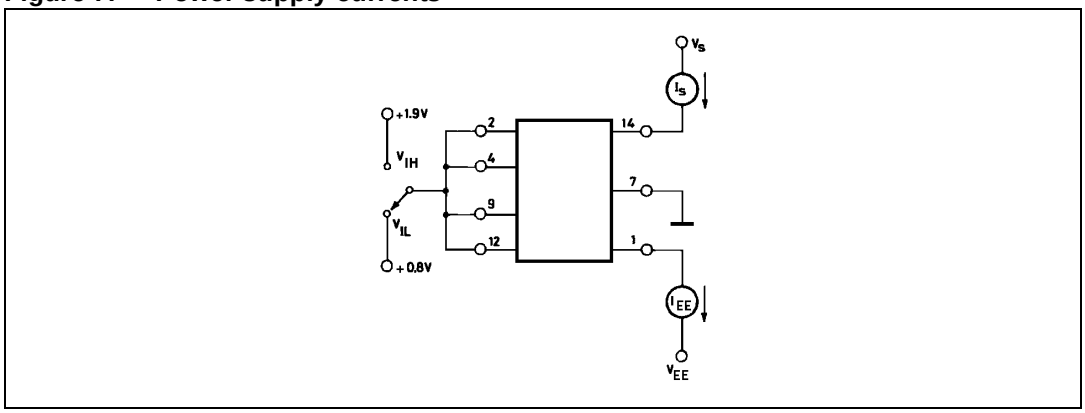


Figure 8. Switching response

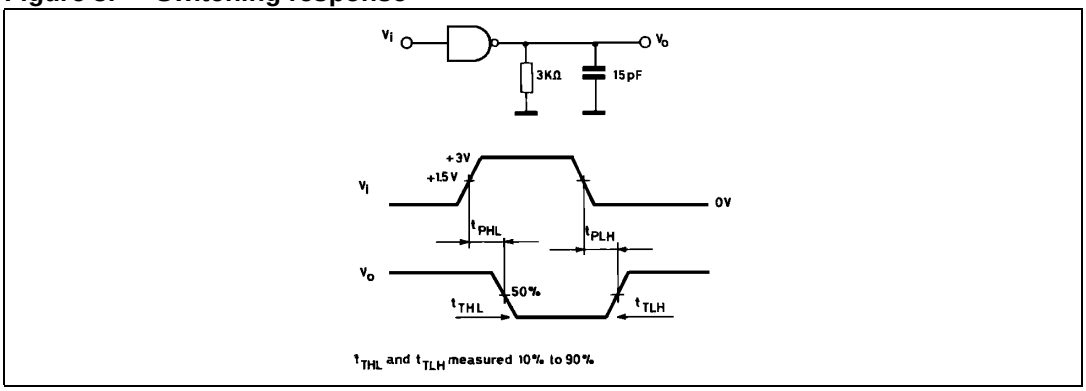


Figure 9. Transfer characteristics vs input voltage

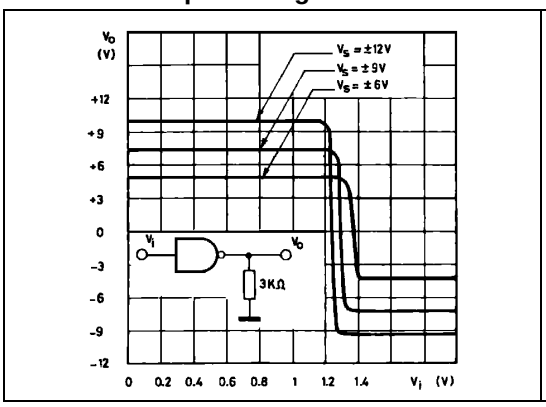


Figure 10. Short-circuit output current vs temperature

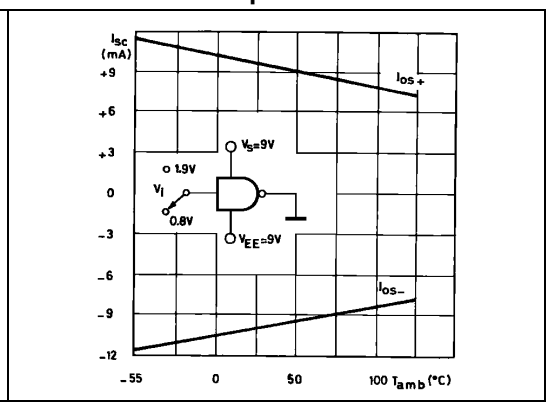


Figure 11. Output slew-rate load capacitance

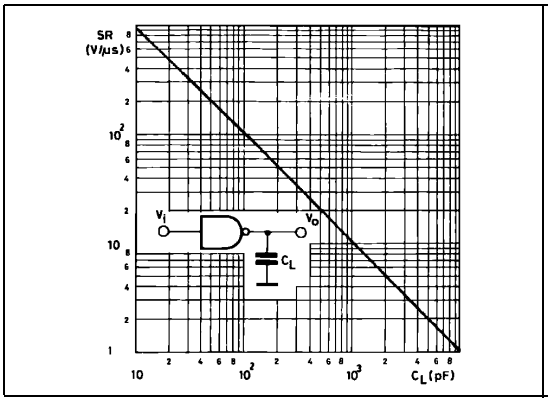


Figure 12. Output voltage and current limiting characteristics

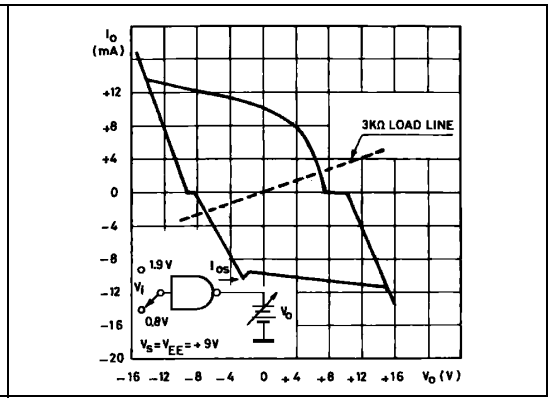
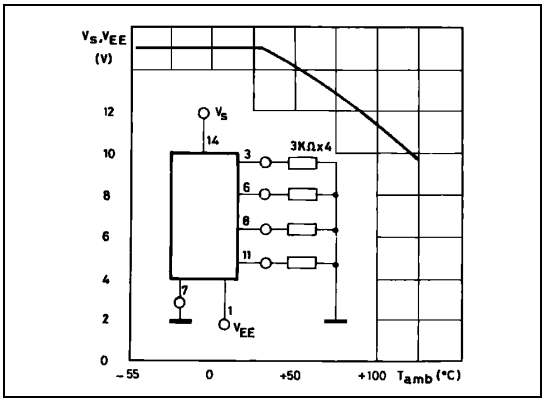
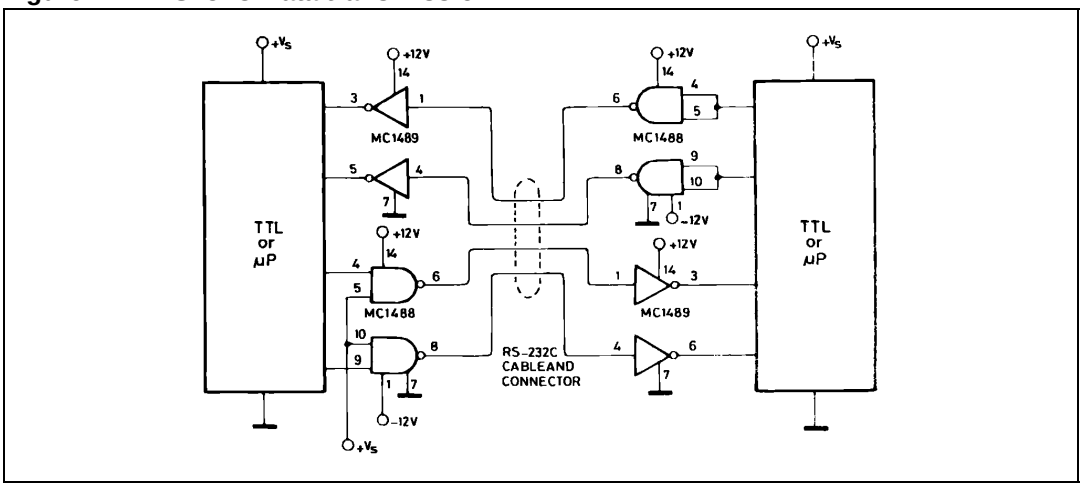


Figure 13. Maximum operating temperature vs power supply voltage



6 Typical applications

Figure 14. RS232C Data transmission



6.1 Application information

The Electronic Industries Association (EIA) has released the RS232C specification detailing the requirements for the interface between data processing 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 RS232C defined levels. The RS232C requirements as applied to drivers are discussed herein.

The required driver voltages are defined as between 5 and 15V in magnitude and are positive for a logic "0" and negative for a logic "1". These voltages are so defined when the drivers are terminated with a 3000 to 7000Ω resistor. The MC1488 meets this voltage requirement by converting a DTL/TTL logic level into RS232C levels with one stage of inversion.

The RS232C specification further requires that during transitions, the driver output slew rate must not exceed 30V per µs. The inherent slew rate of the MC1488 is much too fast for this requirement. The current limited output of the device can be used to control this slew rate by connecting a capacitor to each driver output. The required capacitor can be easily determined by using the relationship $C = I_{OS} \times \Delta T/\Delta V$ from which *Figure 15.* is derived. Accordingly, a 330 pF capacitor on each output will guarantee a worst case slew rate of 30V per µs.

The interface driver is also required to withstand an accidental short to any other conductor in an interconnecting cable. The worst possible signal on any conductor would be another driver using a plus or minus 15V, 500 mA source. The MC1488 is designed to indefinitely withstand such a short to all four outputs in a package as long as the power-supply voltages are greater than 9.0V (i.e., $V_S \geq 9.0V$; $V_{EE} \leq 9.0V$). In some power-supply designs, a loss of system power causes a low impedance on the power-supply outputs. When this occurs, a low impedance to ground would exist at the power inputs to the MC1488 effectively shorting the 300W output resistor to ground. If all four outputs were then shorted to plus or minus 15V, the power dissipation in these resistors would be excessive. Therefore, if the system is designed to permit low impedances to ground at the power-supplies of the drivers, a diode should be placed in each power-supply lead to prevent over-heating in this fault condition.

These two diodes, as shown in Figure 13, could be used to decoupled all the driver packages in a system. (These same diodes will allow the MC1488 to withstand momentary shorts to the ±15V limits specified in the earlier Standard RS232B). The addition of the diodes also permits the MC1488 to withstand faults with power-supplies of less than the 9.0V stated above.

The maximum short-circuit current allowable under fault conditions is more than guaranteed by the previously mentioned 10 mA output current limiting.

The MC1488 is an extremely versatile line driver with a mired of possible applications. Several features of the drivers enhance this versatility:

1. Output Current Limiting - this enables the circuit designer to define the output voltage levels independent of power-supplies and can be accomplished by diode clamping of the output pins.

2. Power-Supply Range - as can be seen from the schematic drawing of the drivers, the positive and negative driving elements of the device are essentially independent and do not require matching power-supplies. In fact, the positive supply can very from a minimum seven volts (required for driving the negative pulldown section) to the maximum specified 15V. The negative supply can vary from approximately -2.5V to the minimum specified -15V. The MC1488 will drive the output to within 2V of the positive or negative supplies as long as the current output limits are not exceeded. The combination of the current-limiting and supply-voltage features allow a wide combination of possible outputs within the same quad package.

Figure 15. Slew-rate load vs capacitance for I_{SC} = 10mA

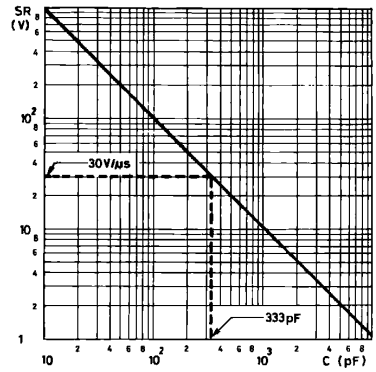
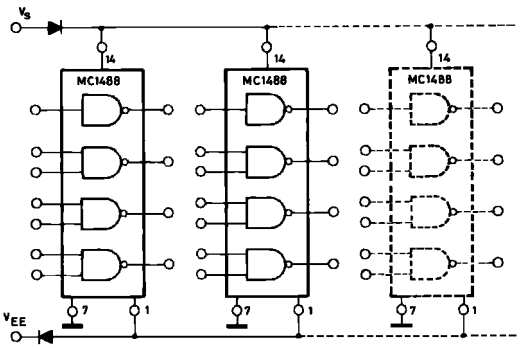
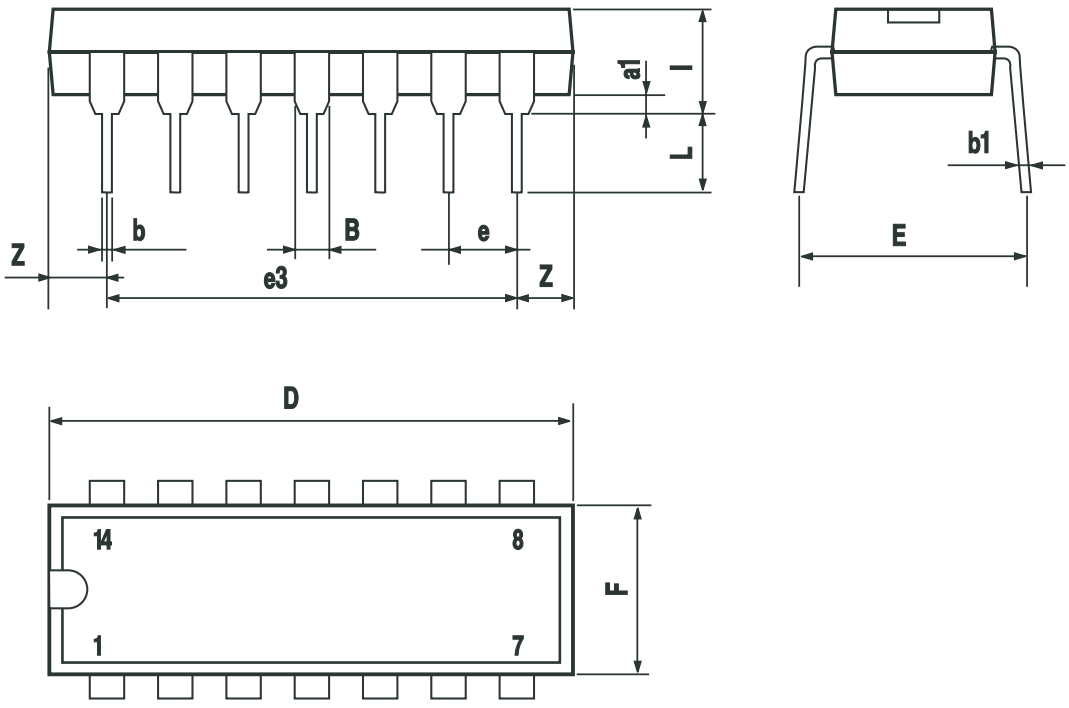


Figure 16. Power supply protection to meet Power-off fault conditions



Plastic DIP-14 MECHANICAL DATA

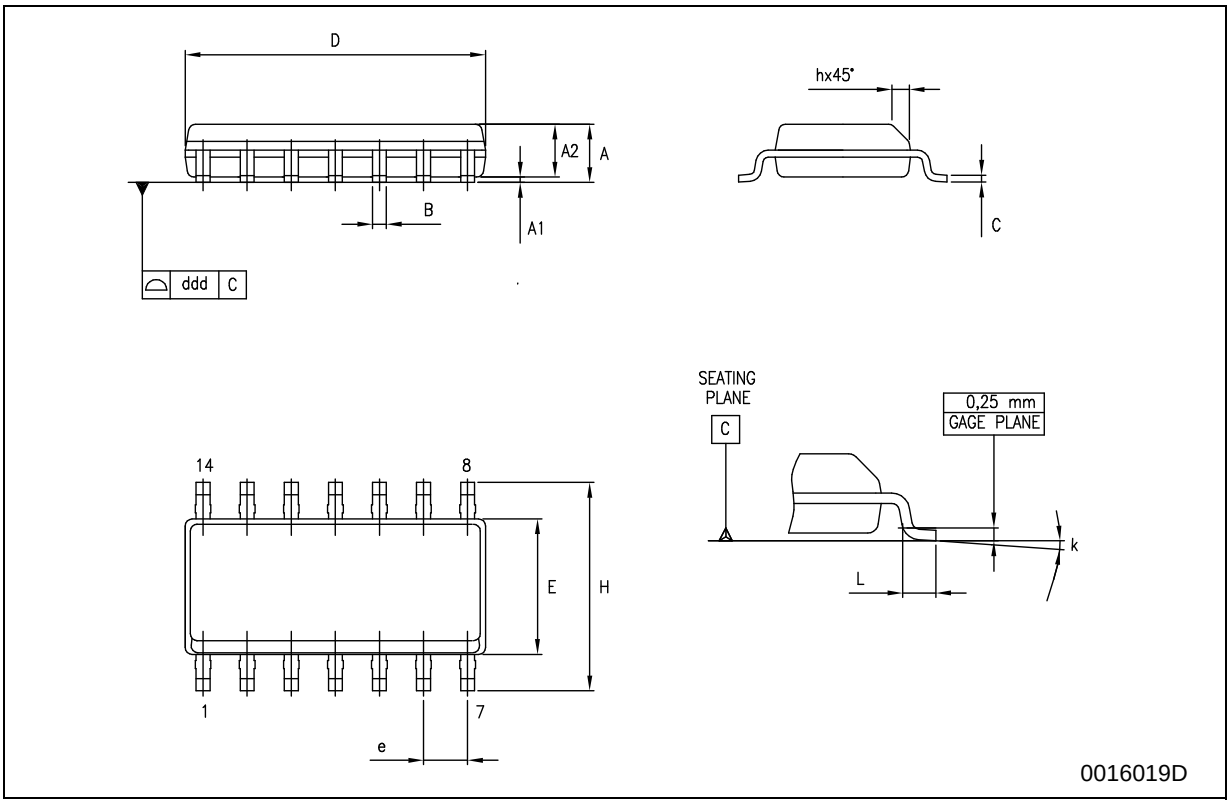
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100



P001A

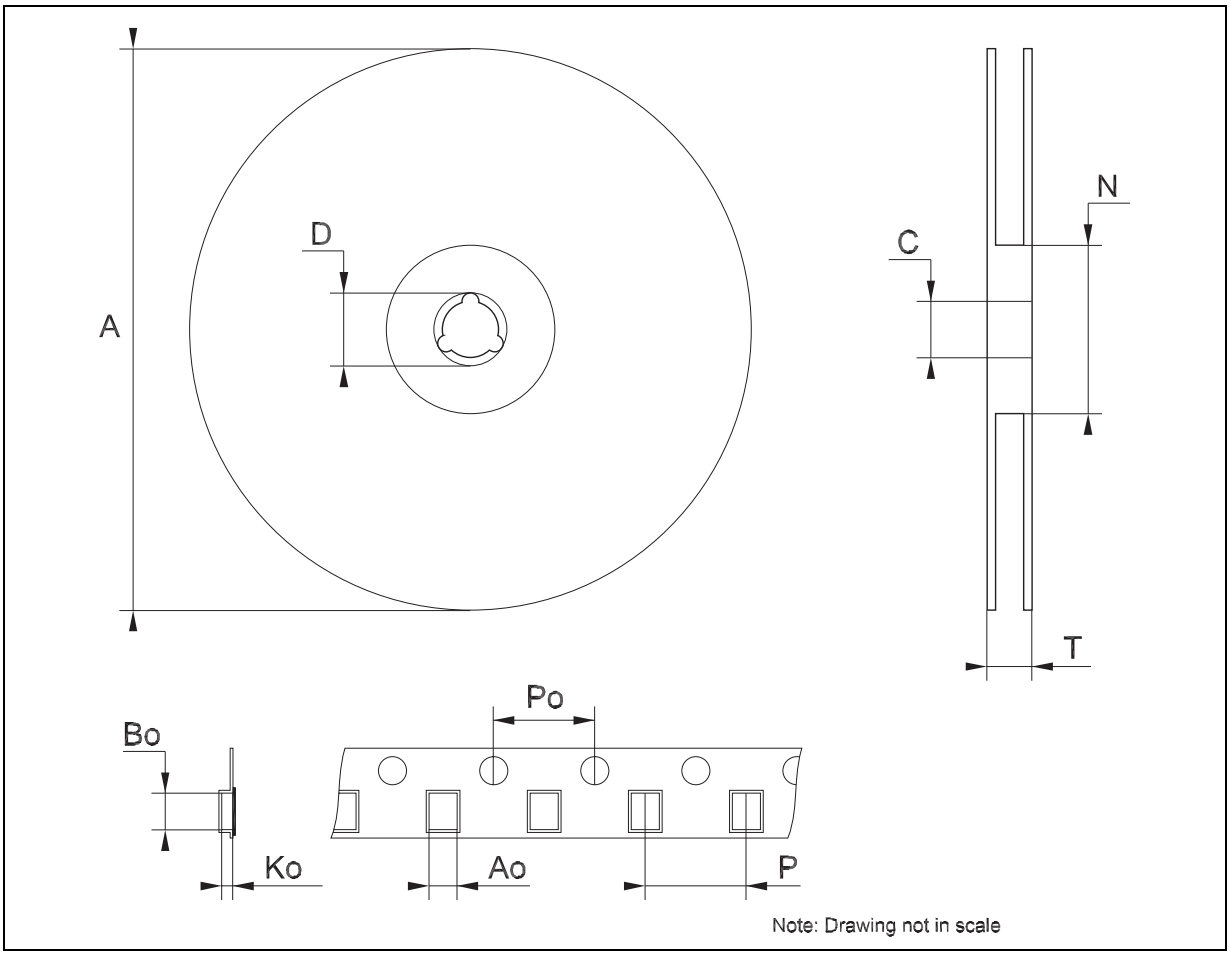
SO-14 MECHANICAL DATA

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

7 Revision history

Table 5. Revision history

Date	Revision	Changes
17-Mar-2006	4	Order codes has been updated and new template.

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