

INTEGRATED CIRCUITS

DATA SHEET

For a complete data sheet, please also download:

- The IC04 LOCMOS HE4000B Logic Family Specifications HEF, HEC
- The IC04 LOCMOS HE4000B Logic Package Outlines/Information HEF, HEC

HEF4001UB gates Quadruple 2-input NOR gate

Product specification
File under Integrated Circuits, IC04

January 1995

Quadruple 2-input NOR gate

HEF4001UB
gates

DESCRIPTION

The HEF4001UB is a quadruple 2-input NOR gate. This unbuffered single stage version provides a direct implementation of the NOR function. The output impedance and output transition time depends on the input voltage and input rise and fall times applied.

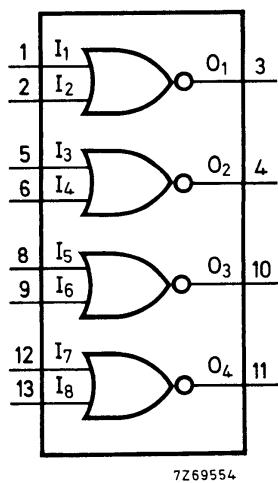


Fig.1 Functional diagram.

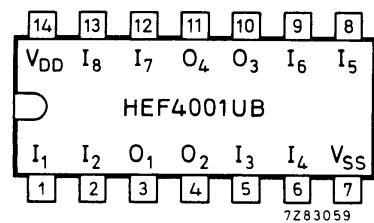


Fig.2 Pinning diagram.

HEF4001UBP(N): 14-lead DIL; plastic (SOT27-1)

HEF4001UBD(F): 14-lead DIL; ceramic (cerdip) (SOT73)

HEF4001UBT(D): 14-lead SO; plastic (SOT108-1)

(): Package Designator North America

FAMILY DATA, I_{DD} LIMITS category GATES

See Family Specifications for V_{IH}/V_{IL} unbuffered stages

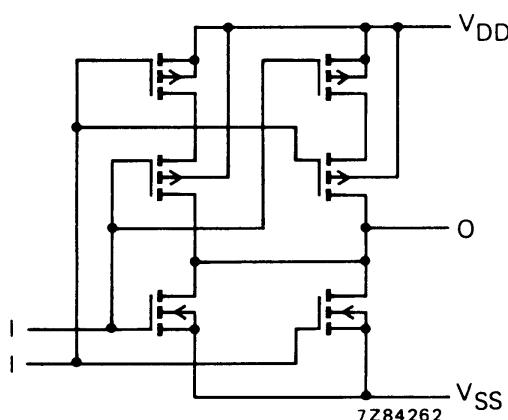


Fig.3 Schematic diagram (one gate). The splitting-up of the p-transistors provide identical inputs.

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AC CHARACTERISTICS

 $V_{SS} = 0$ V; $T_{amb} = 25$ °C; $C_L = 50$ pF; input transition times ≤ 20 ns

	V_{DD} V	SYMBOL	TYP.	MAX.	TYPICAL EXTRAPOLATION FORMULA
Propagation delays $I_n \rightarrow O_n$ HIGH to LOW	5 10 15	t_{PHL}	65 30 25	130 60 50	ns ns ns
					30 ns + (0,70 ns/pF) C_L 17 ns + (0,27 ns/pF) C_L 15 ns + (0,20 ns/pF) C_L
LOW to HIGH	5 10 15	t_{PLH}	40 20 15	80 40 30	ns ns ns
					13 ns + (0,55 ns/pF) C_L 9 ns + (0,23 ns/pF) C_L 7 ns + (0,16 ns/pF) C_L
Output transition times HIGH to LOW	5 10 15	t_{THL}	75 30 20	150 60 40	ns ns ns
					15 ns + (1,20 ns/pF) C_L 6 ns + (0,48 ns/pF) C_L 4 ns + (0,32 ns/pF) C_L
LOW to HIGH	5 10 15	t_{TLH}	60 30 20	110 60 40	ns ns ns
					10 ns + (1,00 ns/pF) C_L 9 ns + (0,42 ns/pF) C_L 6 ns + (0,28 ns/pF) C_L
Input capacitance		C_{IN}	–	10	pF

	V_{DD} V	TYPICAL FORMULA FOR P (μ W)	
Dynamic power dissipation per package (P)	5 10 15	$500 f_i + \sum (f_o C_L) \times V_{DD}^2$ $5000 f_i + \sum (f_o C_L) \times V_{DD}^2$ $30\ 000 f_i + \sum (f_o C_L) \times V_{DD}^2$	where f_i = input freq. (MHz) f_o = output freq. (MHz) C_L = load capacitance (pF) $\sum(f_o C_L)$ = sum of outputs V_{DD} = supply voltage (V)

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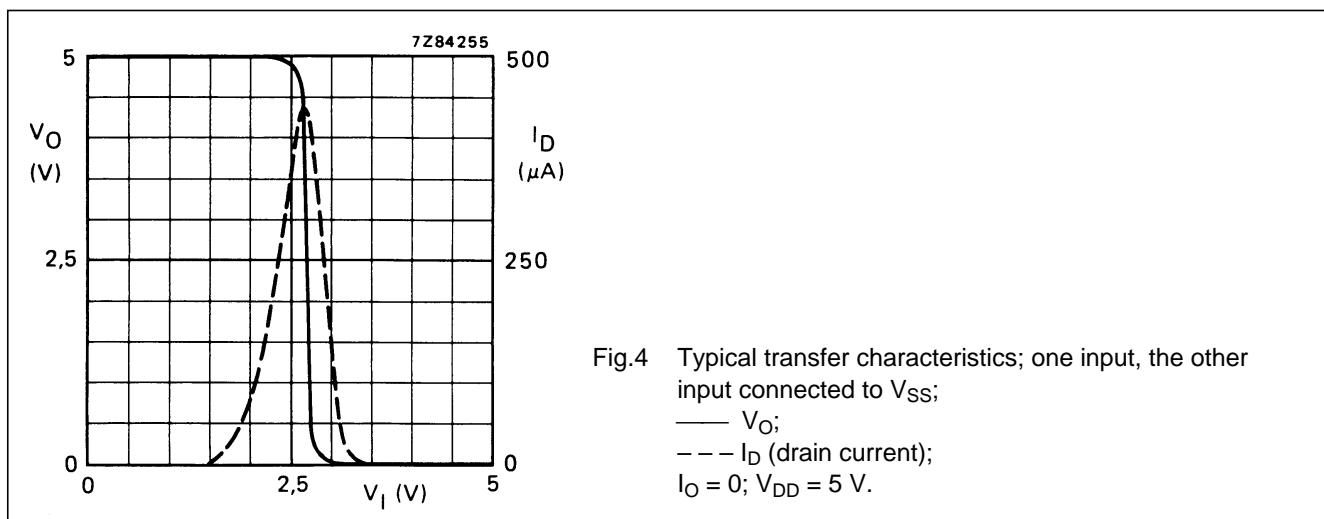
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Fig.4 Typical transfer characteristics; one input, the other input connected to V_{SS} ;
 —— V_O ;
 - - - I_D (drain current);
 $I_O = 0$; $V_{DD} = 5$ V.

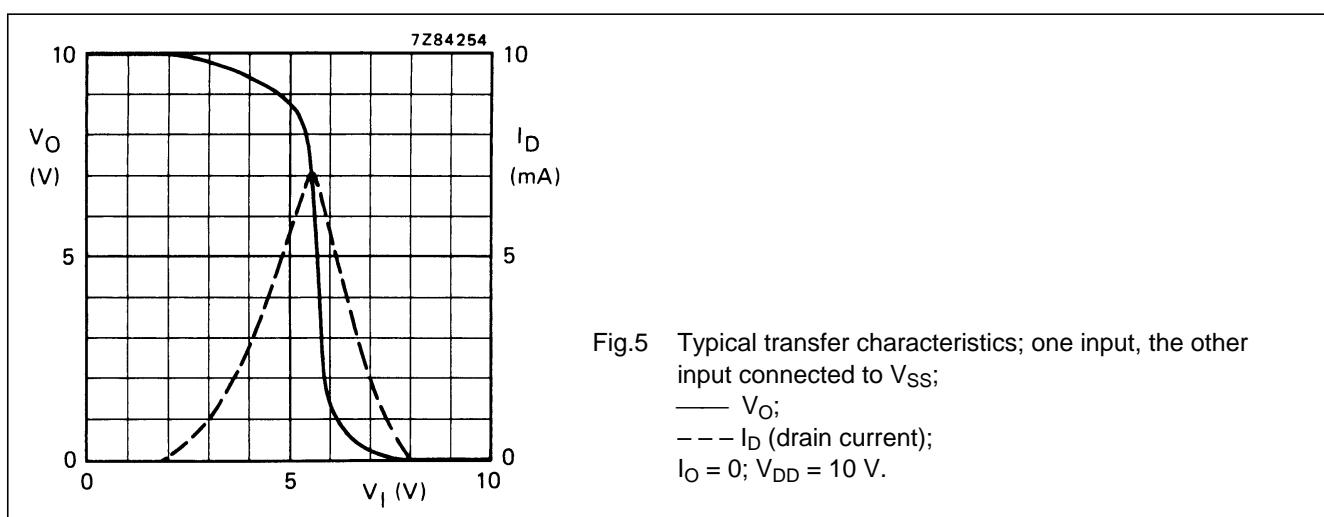


Fig.5 Typical transfer characteristics; one input, the other input connected to V_{SS} ;
 —— V_O ;
 - - - I_D (drain current);
 $I_O = 0$; $V_{DD} = 10$ V.

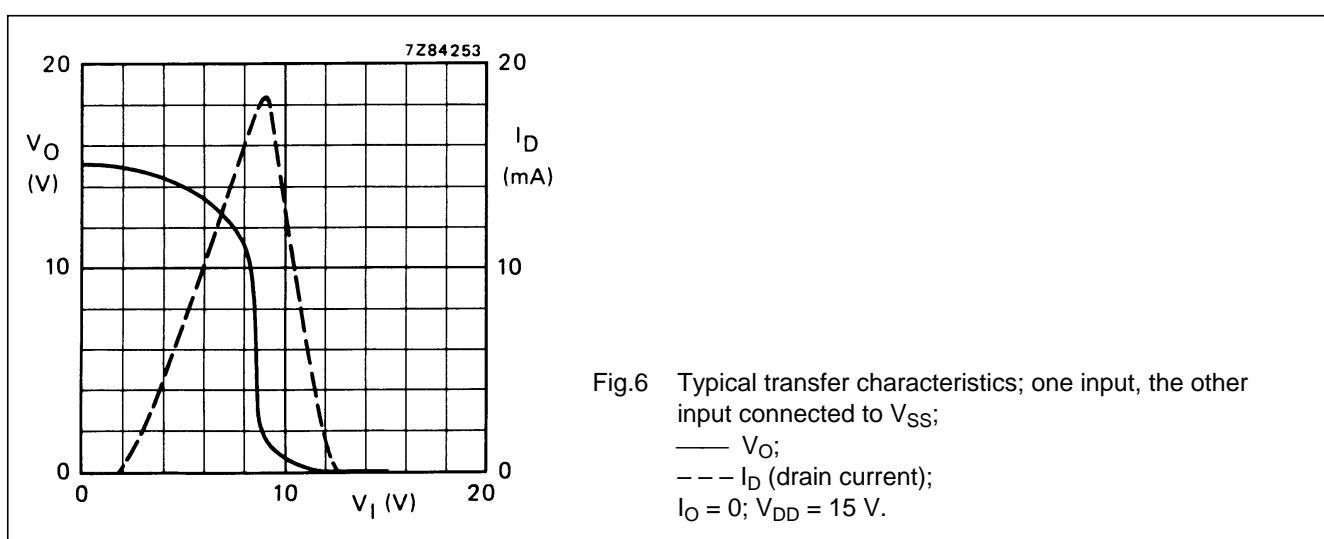
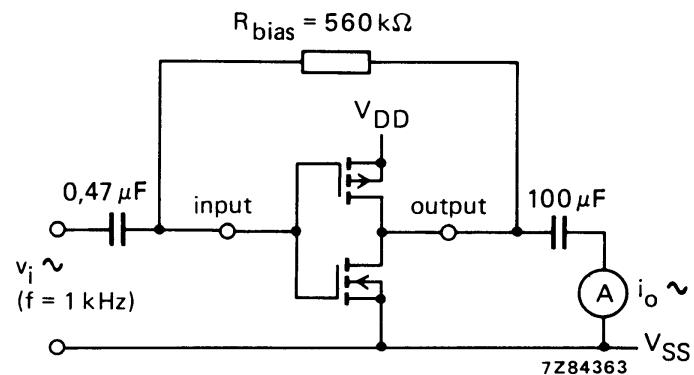
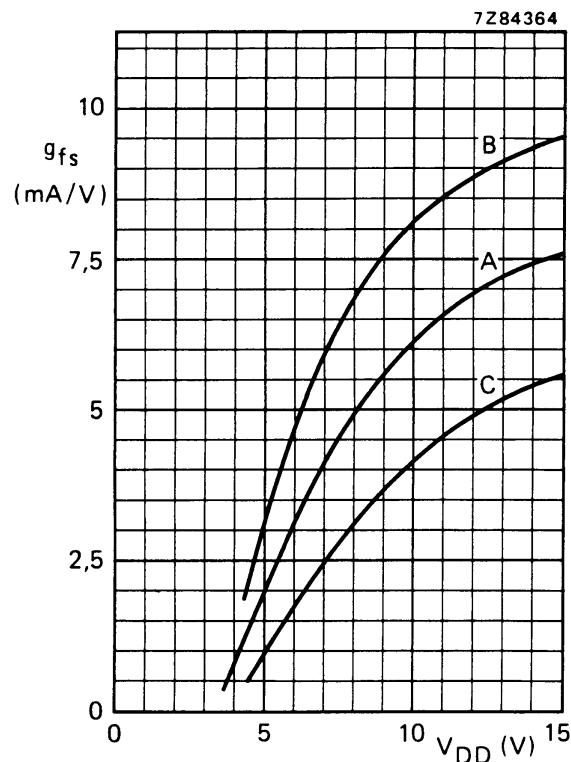


Fig.6 Typical transfer characteristics; one input, the other input connected to V_{SS} ;
 —— V_O ;
 - - - I_D (drain current);
 $I_O = 0$; $V_{DD} = 15$ V.

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A : average,
 B : average + 2 s,
 C : average - 2 s, in where 's' is the observed standard deviation.

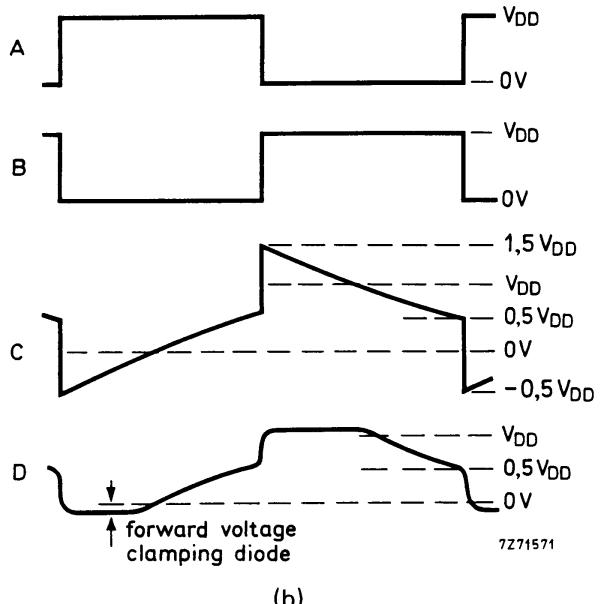
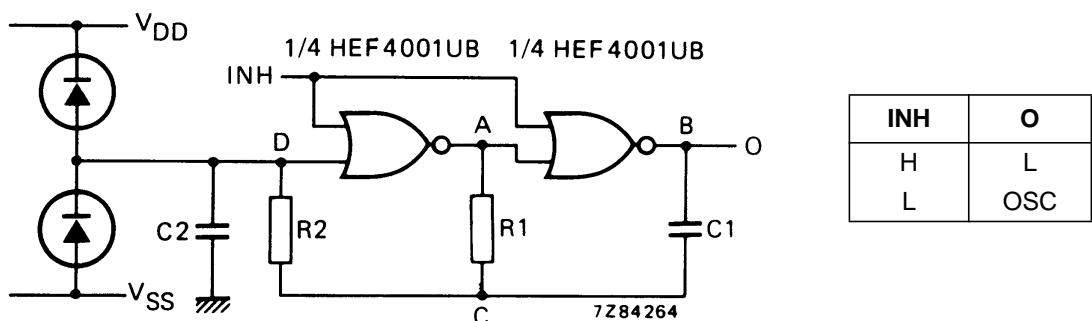
Fig.8 Typical forward transconductance g_{fs} as a function of the supply voltage at $T_{amb} = 25^{\circ}\text{C}$.

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APPLICATION INFORMATION

Some examples of applications for the HEF4001UB are shown below. Because of the fact that this circuit is unbuffered, it is suitable for use in (partly) analogue circuits.



In Fig.9 the oscillation frequency is mainly determined by $R1C1$, provided $R1 \ll R2$ and $R2C2 \ll R1C1$.

The function of R_2 is to minimize the influence of the forward voltage across the protection diodes on the frequency; C_2 is a stray (parasitic) capacitance. The period T_p is given by $T_p = T_1 + T_2$, in which

$$T_1 = R1C1 \ln \frac{V_{DD} + V_{ST}}{V_{ST}} \text{ and } T_2 = R1C1 \ln \frac{2V_{DD} - V_{ST}}{V_{DD} - V_{ST}} \text{ where}$$

V_{ST} is the signal threshold level of the gate. The period is fairly independent of V_{DD} , V_{ST} and temperature. The duty factor, however, is influenced by V_{ST} .

Fig.9 (a) Astable relaxation oscillator using two HEF4001UB gates; the diodes may be BAW62; C2 is a parasitic capacitance.
 (b) Waveforms at the points marked A, B, C and D in the circuit diagram.

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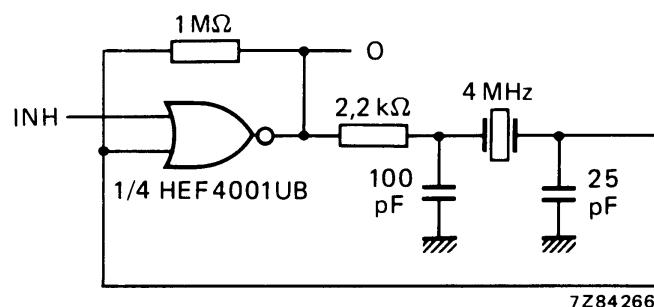
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Fig.10 Example of a crystal oscillator using one HEF4001UB gate.

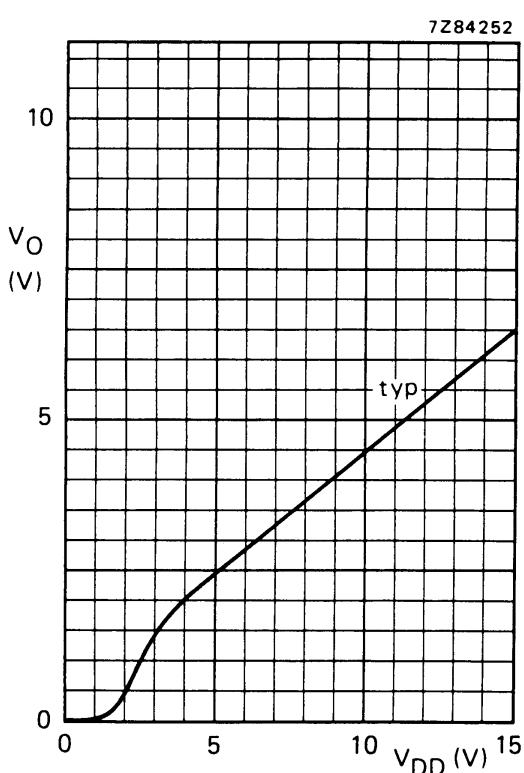
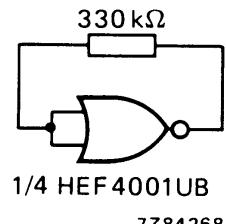


Fig.11 Output voltages as a function of supply voltage.

Fig.12 Test set-up for measuring graph of Fig.11.
Condition: all other inputs connected to ground.

NOTES

If a gate is just used as an amplifying inverter, there are two possibilities:

1. Connecting the inputs together gives simpler wiring, but makes the device output not completely symmetrical.
2. Connecting one input to V_{SS} will give the device a symmetrical output.

Quadruple 2-input NOR gate

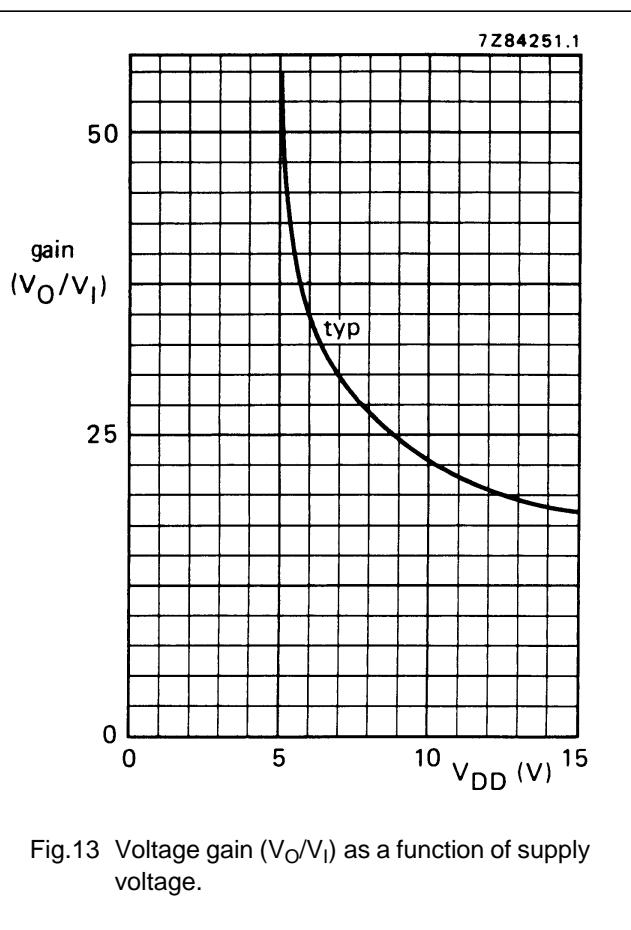
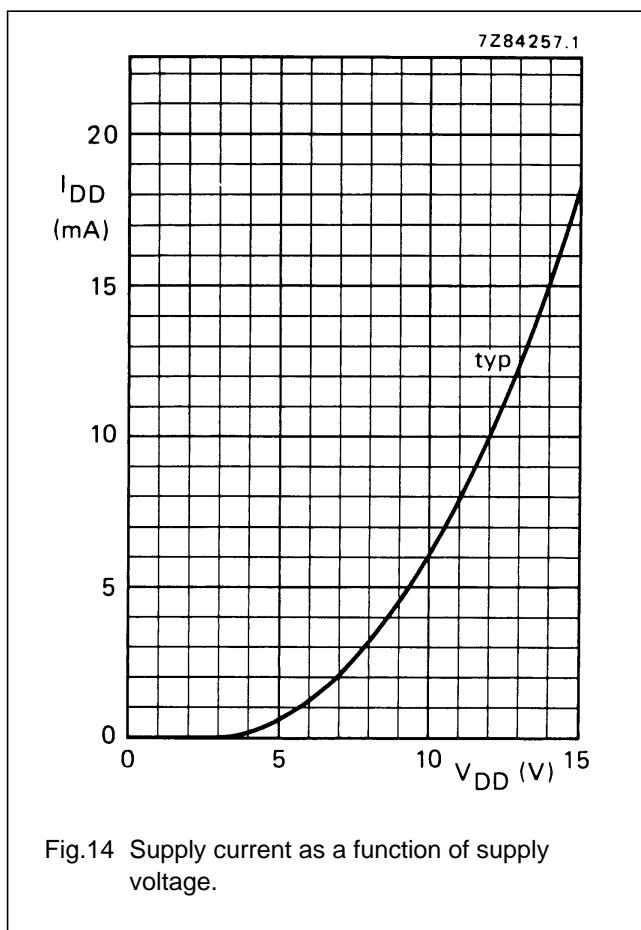
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Fig.14 Supply current as a function of supply voltage.

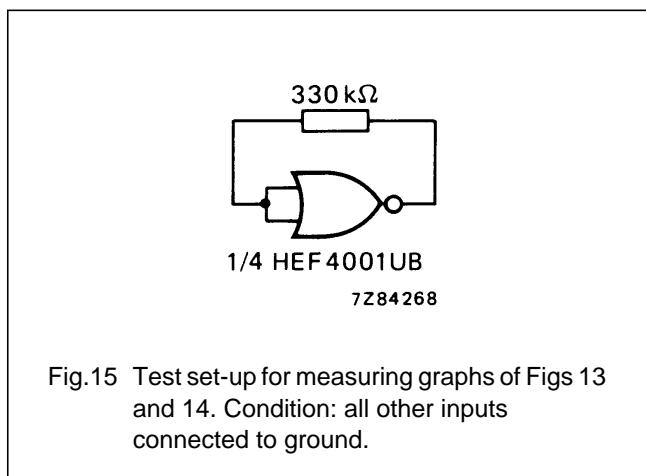


Fig.15 Test set-up for measuring graphs of Figs 13 and 14. Condition: all other inputs connected to ground.

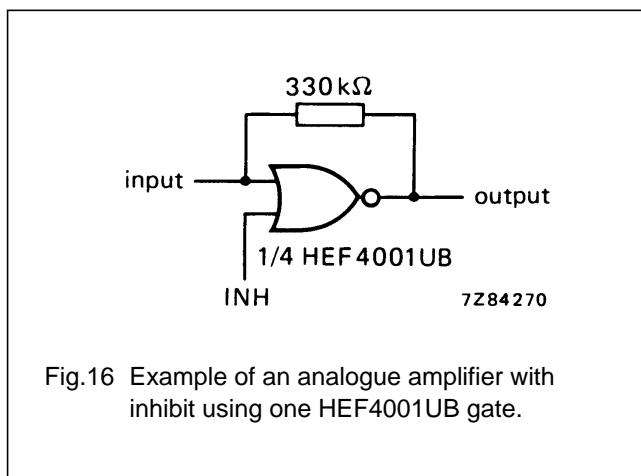


Fig.16 Example of an analogue amplifier with inhibit using one HEF4001UB gate.