

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

HEF4069UB **gates** Hex inverter

Product specification
File under Integrated Circuits, IC04

January 1995

Hex inverter

HEF4069UB
gates

DESCRIPTION

The HEF4069UB is a general purpose hex inverter. Each of the six inverters is a single stage.

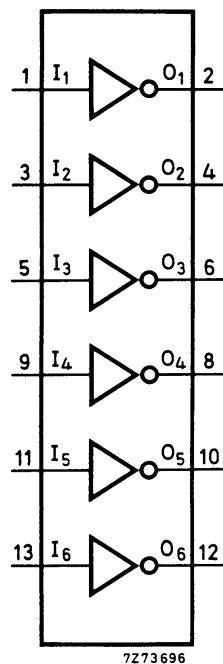


Fig.1 Functional diagram.

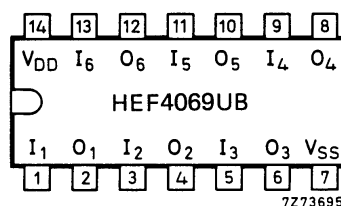


Fig.2 Pinning diagram.

HEF4069UBP(N): 14-lead DIL; plastic
(SOT27-1)

HEF4069UBD(F): 14-lead DIL; ceramic (cerdip)
(SOT73)

HEF4069UBT(D): 14-lead SO; plastic
(SOT108-1)

(): Package Designator North America

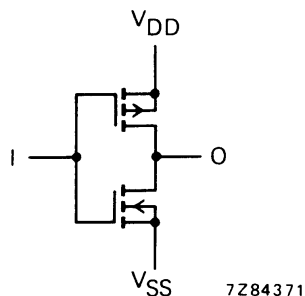


Fig.3 Schematic diagram (one inverter).

FAMILY DATA, I_{DD} LIMITS category GATES

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

Hex inverter

HEF4069UB
gates**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	t_{PHL}	45	90 ns	18 ns + (0,55 ns/pF) C_L
	10		20	40 ns	9 ns + (0,23 ns/pF) C_L
	15		15	25 ns	7 ns + (0,16 ns/pF) C_L
	5	t_{PLH}	40	80 ns	13 ns + (0,55 ns/pF) C_L
	10		20	40 ns	9 ns + (0,23 ns/pF) C_L
	15		15	30 ns	7 ns + (0,16 ns/pF) C_L
Output transition times HIGH to LOW	5	t_{THL}	60	120 ns	10 ns + (1,0 ns/pF) C_L
	10		30	60 ns	9 ns + (0,42 ns/pF) C_L
	15		20	40 ns	6 ns + (0,28 ns/pF) C_L
	5	t_{TLH}	60	120 ns	10 ns + (1,0 ns/pF) C_L
	10		30	60 ns	9 ns + (0,42 ns/pF) C_L
	15		20	40 ns	6 ns + (0,28 ns/pF) C_L

	V_{DD} V	TYPICAL FORMULA FOR P (μ W)	
Dynamic power dissipation per package (P)	5	$600 f_i + \sum (f_o C_L) \times V_{DD}^2$	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)
	10	$4\,000 f_i + \sum (f_o C_L) \times V_{DD}^2$	
	15	$22\,000 f_i + \sum (f_o C_L) \times V_{DD}^2$	

Hex inverter

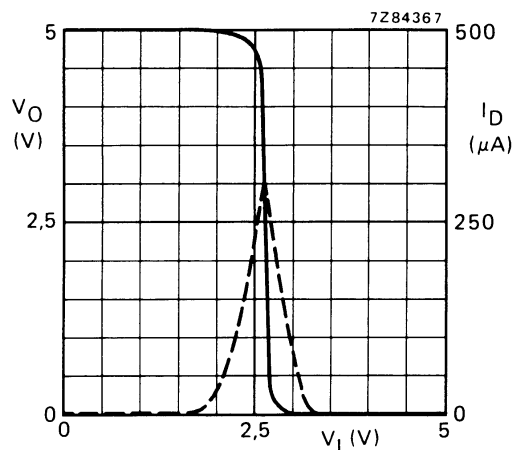
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Fig. 4 Typical transfer characteristics;
 — V_O ;
 --- I_D (drain current);
 $I_O = 0$; $V_{DD} = 5$ V.

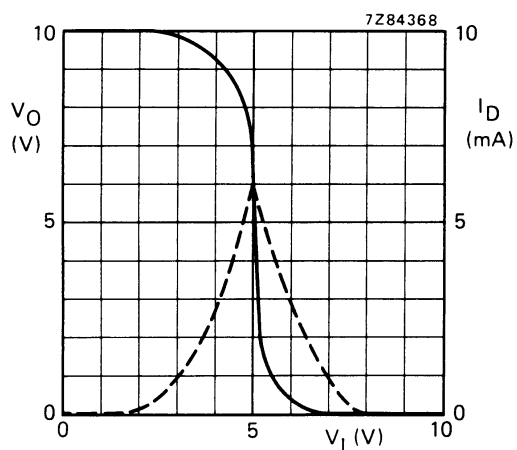


Fig. 5 Typical transfer characteristics;
 — V_O ;
 --- I_D (drain current);
 $I_O = 0$; $V_{DD} = 10$ V.

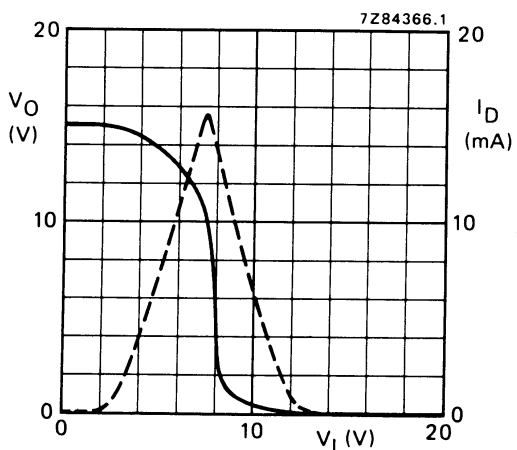


Fig. 6 Typical transfer characteristics;
 — V_O ;
 --- I_D (drain current);
 $I_O = 0$; $V_{DD} = 15$ V.

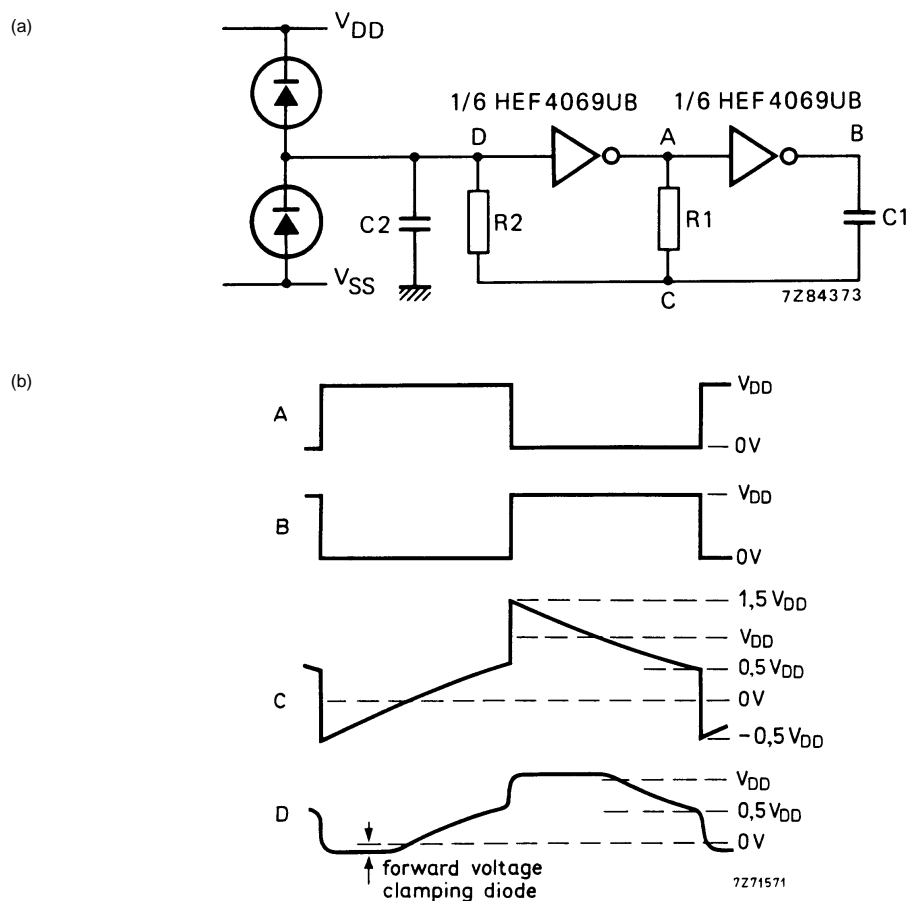
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HEF4069UB
gates

APPLICATION INFORMATION

Some examples of applications for the HEF4069UB are shown below.

In Fig.7 an astable relaxation oscillator is given. The oscillation frequency is mainly determined by $R1C1$, provided $R1 \ll R2$ and $R2C2 \ll R1C1$.



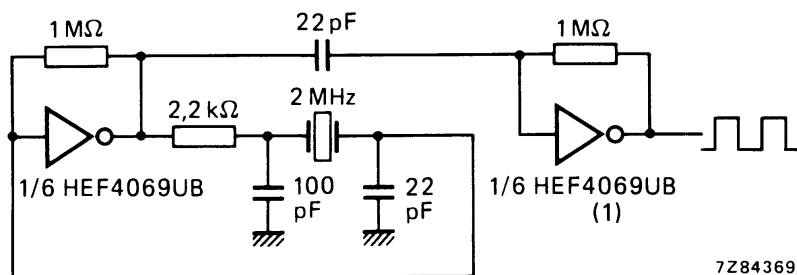
The function of $R2$ is to minimize the influence of the forward voltage across the protection diodes on the frequency; $C2$ is a stray (parasitic) capacitance. The period T_p is given by $T_p = T_1 + T_2$, in which

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

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

Fig.7 (a) Astable relaxation oscillator using two HEF4069UB inverters; 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.

Hex inverter

HEF4069UB
gates

(1) This inverter is added to amplify the oscillator output voltage to a level sufficient to drive other LOCMOS circuits.

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Fig.8 Crystal oscillator for frequencies up to 10 MHz, using two HEF4069UB inverters.

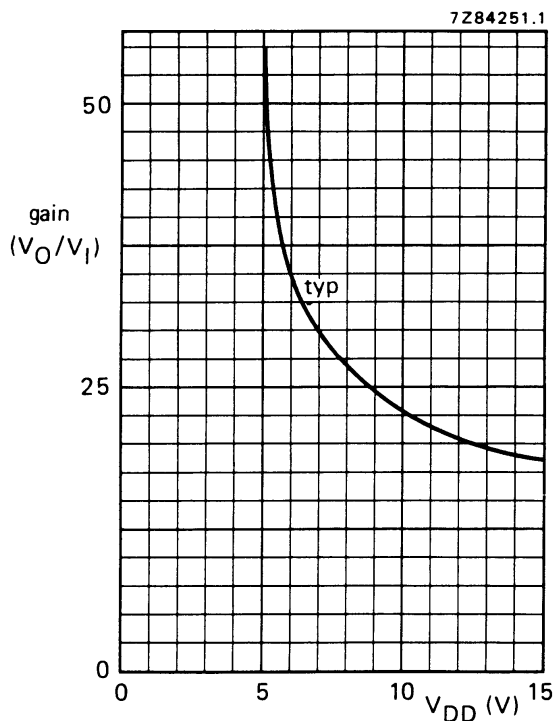
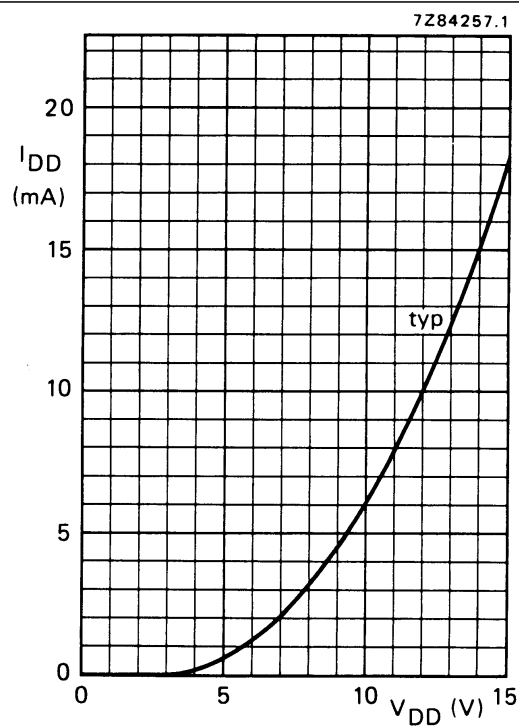
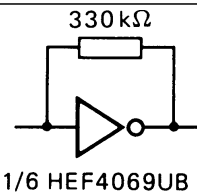
Fig.9 Voltage gain (V_O/V_I) as a function of supply voltage.

Fig.10 Supply current as a function of supply voltage.



It is also an example of an analogue amplifier using one HEF4069UB.

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Fig.11 Test set-up for measuring graphs of Figs 9 and 10.

Hex inverter

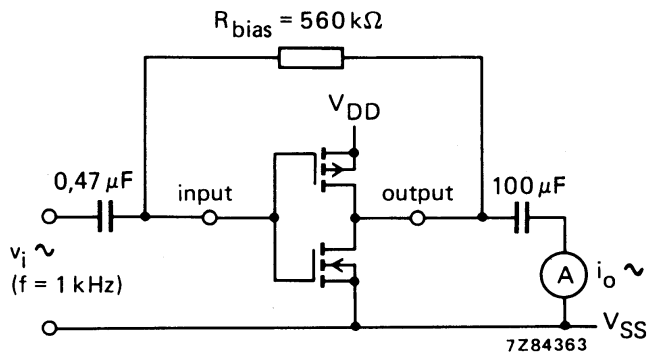
HEF4069UB
gates

Fig.12 Test set-up for measuring forward transconductance $g_{fs} = di_o/dv_i$ at v_o is constant (see also graph Fig.13).

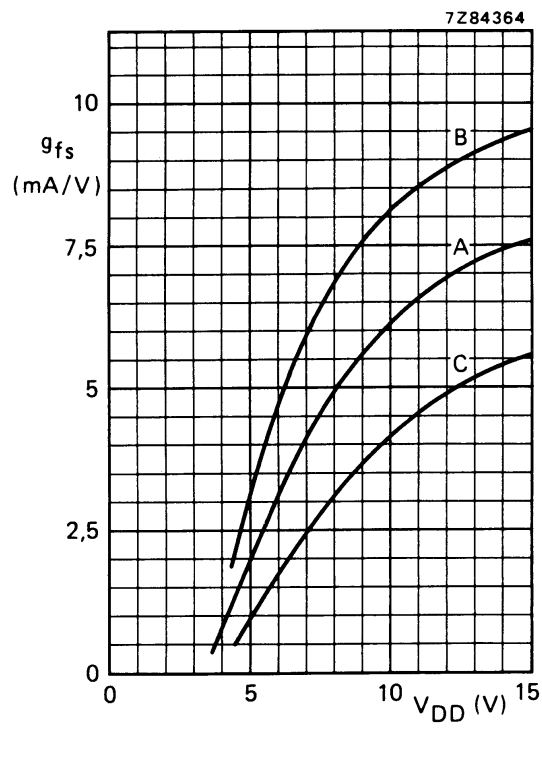


Fig.13 Typical forward transconductance g_{fs} as a function of the supply voltage at $T_{\text{amb}} = 25^\circ\text{C}$.