

# 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

## **HEF40106B** **gates** HEX inverting Schmitt trigger

Product specification  
File under Integrated Circuits, IC04

January 1995

# HEX inverting Schmitt trigger

## HEF40106B gates

### HEX INVERTING SCHMITT TRIGGER

Each circuit of the HEF40106B functions as an inverter with Schmitt-trigger action. The Schmitt-trigger switches at different points for the positive-going and negative-going input signals. The difference between the positive-going voltage ( $V_P$ ) and the negative-going voltage ( $V_N$ ) is defined as hysteresis voltage ( $V_H$ ).

This device may be used for enhanced noise immunity or to "square up" slowly changing waveforms.

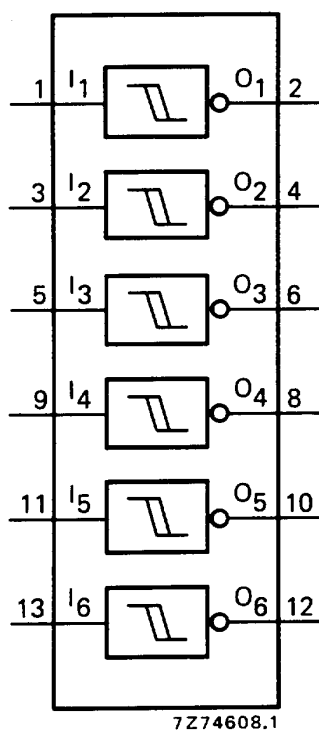


Fig. 1 Functional diagram.

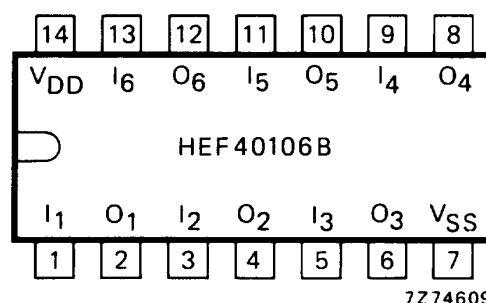


Fig. 2 Pinning diagram.

HEF40106BP(N): 14-lead DIL; plastic  
(SOT27-1)

HEF40106BD(F): 14-lead DIL; ceramic (cerdip)  
(SOT73)

HEF40106BT(D): 14-lead SO; plastic  
(SOT108-1)

( ): Package Designator North America

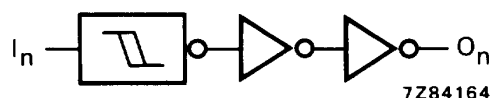


Fig. 3 Logic diagram (one inverter).

FAMILY DATA

$I_{DD}$  LIMITS category GATES

see Family Specifications

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D.C. CHARACTERISTICS

$V_{SS} = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$

	$V_{DD}$ V	symbol	min.	typ.	max.
Hysteresis voltage	5	$V_H$	0,5	0,8	V
	10		0,7	1,3	V
	15		0,9	1,8	V
Switching levels positive-going input voltage	5	$V_P$	2	3,0	3,5 V
	10		3,7	5,8	7 V
	15		4,9	8,3	11 V
negative-going input voltage	5	$V_N$	1,5	2,2	3 V
	10		3	4,5	6,3 V
	15		4	6,5	10,1 V

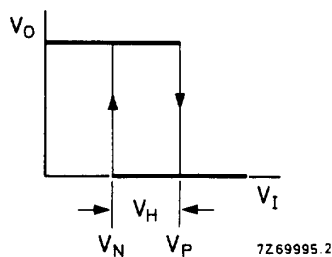


Fig. 4 Transfer characteristic.

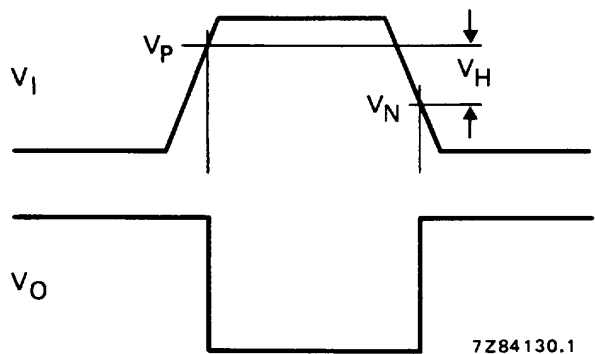


Fig. 5 Waveforms showing definition of  $V_P$ ,  $V_N$  and  $V_H$ , where  $V_N$  and  $V_P$  are between limits of 30% and 70%.

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## A.C. CHARACTERISTICS

 $V_{SS} = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $C_L = 50\text{ pF}$ ; input transition times  $\leq 20\text{ ns}$ 

	$V_{DD}$ V	symbol	typ.	max.		typical extrapolation formula
Propagation delays $I_n \rightarrow O_n$ HIGH to LOW	5	$t_{PHL}$	90	180	ns	$63\text{ ns} + (0,55\text{ ns/pF}) C_L$
	10		35	70	ns	$24\text{ ns} + (0,23\text{ ns/pF}) C_L$
	15		30	60	ns	$22\text{ ns} + (0,16\text{ ns/pF}) C_L$
LOW to HIGH	5	$t_{PLH}$	75	150	ns	$48\text{ ns} + (0,55\text{ ns/pF}) C_L$
	10		35	70	ns	$24\text{ ns} + (0,23\text{ ns/pF}) C_L$
	15		30	60	ns	$22\text{ ns} + (0,16\text{ ns/pF}) C_L$
Output transition times HIGH to LOW	5	$t_{THL}$	60	120	ns	$10\text{ ns} + (1,0\text{ ns/pF}) C_L$
	10		30	60	ns	$9\text{ ns} + (0,42\text{ ns/pF}) C_L$
	15		20	40	ns	$6\text{ ns} + (0,28\text{ ns/pF}) C_L$
LOW to HIGH	5	$t_{TLH}$	60	120	ns	$10\text{ ns} + (1,0\text{ ns/pF}) C_L$
	10		30	60	ns	$9\text{ ns} + (0,42\text{ ns/pF}) C_L$
	15		20	40	ns	$6\text{ ns} + (0,28\text{ ns/pF}) C_L$

	$V_{DD}$ V	typical formula for P ( $\mu\text{W}$ )	where $f_i$ = input freq. (MHz) $f_o$ = output freq. (MHz) $C_L$ = load capacitance (pF) $\Sigma(f_o C_L)$ = sum of outputs $V_{DD}$ = supply voltage (V)
Dynamic power dissipation per package (P)	5	$2\,300 f_i + \Sigma(f_o C_L) \times V_{DD}^2$	
	10	$9\,000 f_i + \Sigma(f_o C_L) \times V_{DD}^2$	
	15	$20\,000 f_i + \Sigma(f_o C_L) \times V_{DD}^2$	

## HEX inverting Schmitt trigger

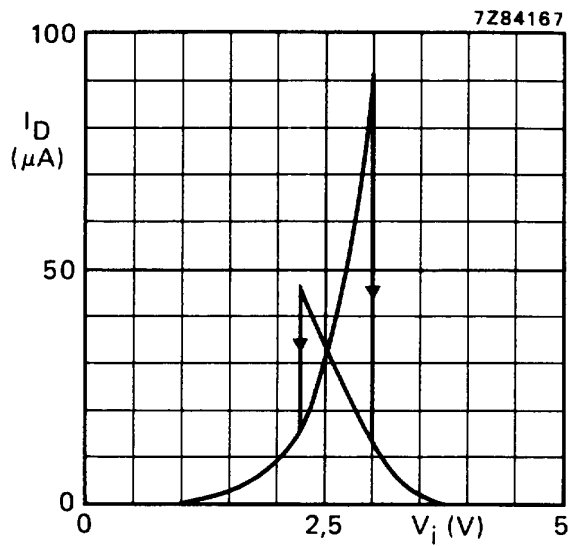
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Fig. 6 Typical drain current as a function of input voltage;  $V_{DD} = 5\text{ V}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ .

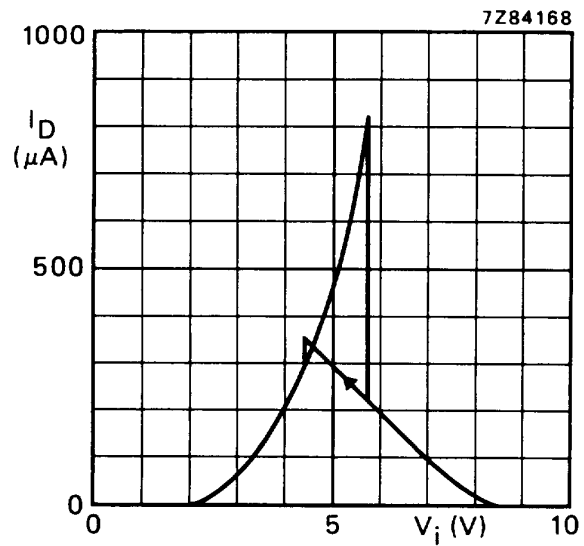


Fig. 7 Typical drain current as a function of input voltage;  $V_{DD} = 10\text{ V}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ .

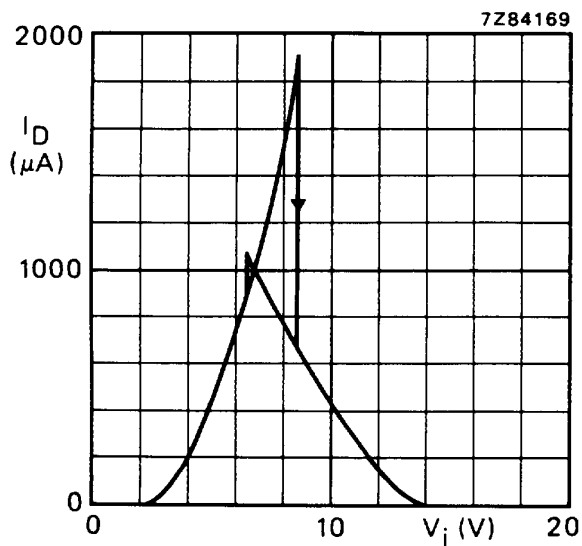


Fig. 8 Typical drain current as a function of input voltage;  $V_{DD} = 15\text{ V}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ .

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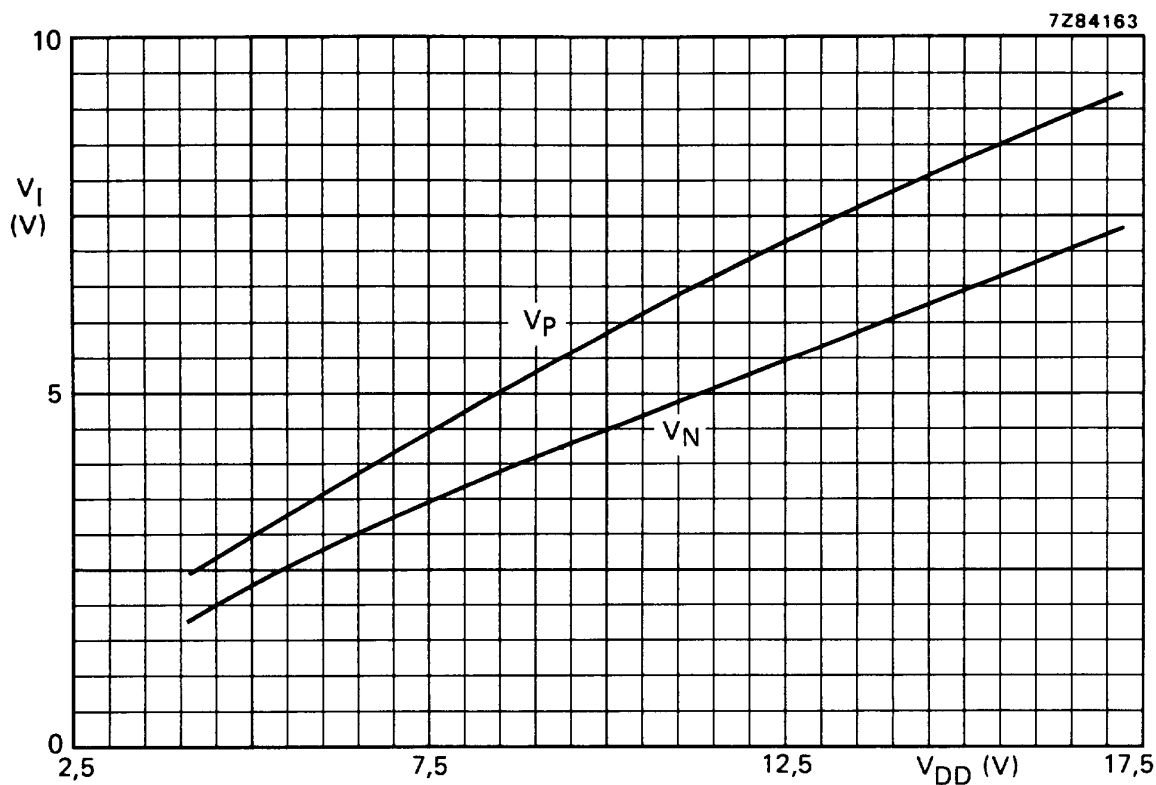
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Fig. 9 Typical switching levels as a function of supply voltage  $V_{DD}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

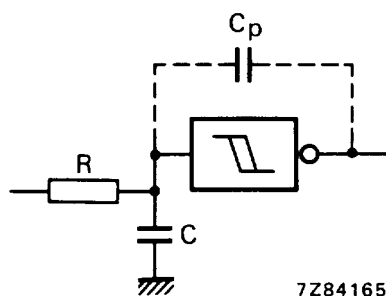


Fig. 10 Schmitt trigger driven via a high impedance ( $R > 1\text{ k}\Omega$ ).

If a Schmitt trigger is driven via a high impedance ( $R > 1\text{ k}\Omega$ ) then it is necessary to incorporate a capacitor  $C$  of such value that:  $\frac{C}{C_p} > \frac{V_{DD}-V_{SS}}{V_H}$ , otherwise oscillation can occur on the edges of a pulse.

$C_p$  is the external parasitic capacitance between input and output; the value depends on the circuit board layout.

## HEX inverting Schmitt trigger

HEF40106B  
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Some examples of applications for the HEF40106B are:

- Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators.

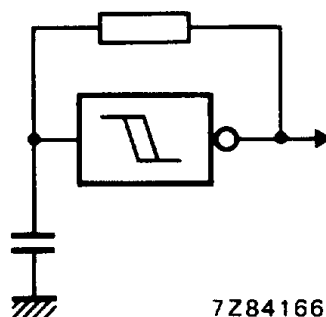


Fig. 11 The HEF40106B used as an astable multivibrator.