

# 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

## HEF4104B

### MSI

Quadruple low to high voltage translator with 3-state outputs

Product specification  
File under Integrated Circuits, IC04

January 1995

# Quadruple low to high voltage translator with 3-state outputs

## HEF4104B MSI

### DESCRIPTION

The HEF4104B quadruple low voltage to high voltage translator with 3-state outputs provides the capability of interfacing low voltage circuits to high voltage circuits, such as low voltage LOCMOS and TTL to high voltage LOCMOS. It has four data inputs ( $I_0$  to  $I_3$ ), an active HIGH output enable input (EO), four data outputs ( $O_0$  to  $O_3$ ) and their complements ( $\bar{O}_0$  to  $\bar{O}_3$ ).

With EO HIGH,  $O_0$  to  $O_3$  and  $\bar{O}_0$  to  $\bar{O}_3$  are in the low impedance ON-state, either HIGH or LOW as determined by  $I_0$  to  $I_3$ ; with EO LOW,  $O_0$  to  $O_3$  and  $\bar{O}_0$  to  $\bar{O}_3$  are in the high impedance OFF-state.

The device uses a common negative supply ( $V_{SS}$ ) and separate positive supplies for inputs ( $V_{DDI}$ ) and outputs ( $V_{DDO}$ ).  $V_{DDI}$  must always be less than or equal to  $V_{DDO}$ , even during power turn-on and turn-off. For the permissible operating range of  $V_{DDI}$  and  $V_{DDO}$  see graph Fig.4.

Each input protection circuit is terminated between  $V_{DDO}$  and  $V_{SS}$ . This allows the input signals to be driven from any potential between  $V_{DDO}$  and  $V_{SS}$ , without regard to current limiting. When driving from potentials greater than  $V_{DDO}$  or less than  $V_{SS}$ , the current at each input must be limited to 10 mA.

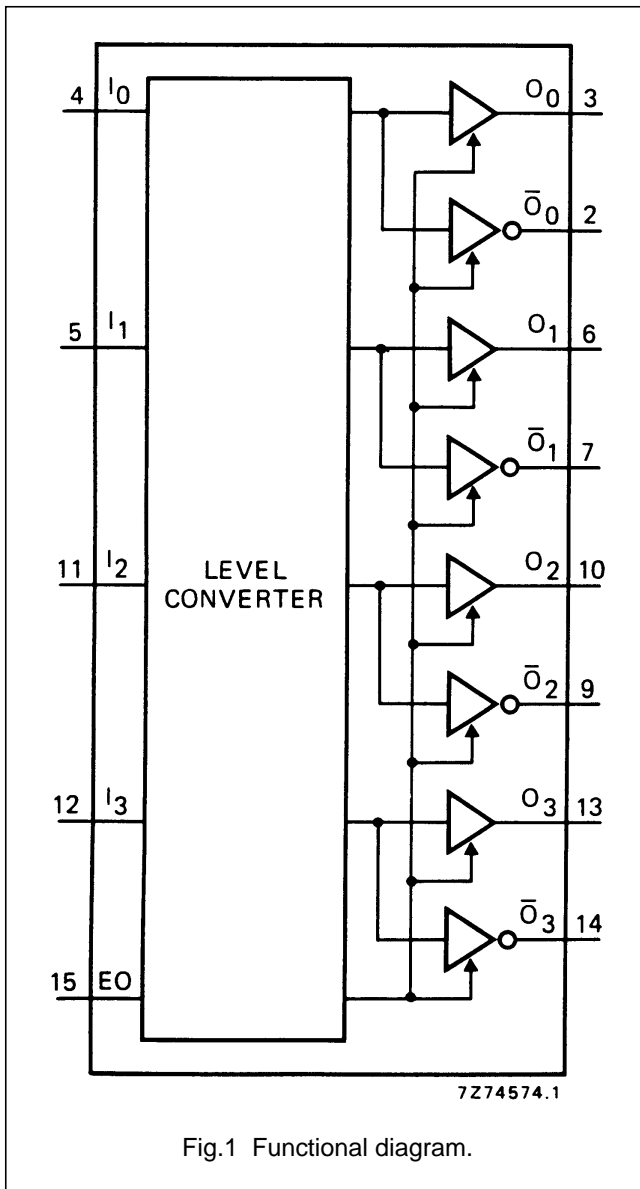


Fig.1 Functional diagram.

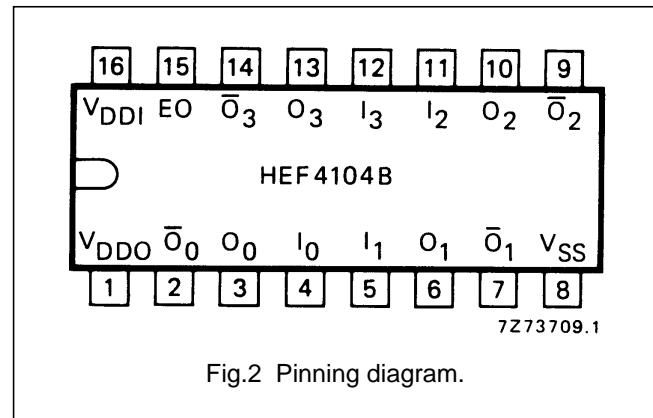


Fig.2 Pinning diagram.

- HEF4104BP(N): 16-lead DIL; plastic (SOT38-1)
- HEF4104BD(F): 16-lead DIL; ceramic (cerdip) (SOT74)
- HEF4104BT(D): 16-lead SO; plastic (SOT109-1)
- ( ): Package Designator North America

### PINNING

- $I_0$  to  $I_3$  data inputs
- EO output enable input
- $O_0$  to  $O_3$  data outputs
- $\bar{O}_0$  to  $\bar{O}_3$  complementary data outputs

### FAMILY DATA, $I_{DD}$ LIMITS category MSI

See Family Specifications

Quadruple low to high voltage translator  
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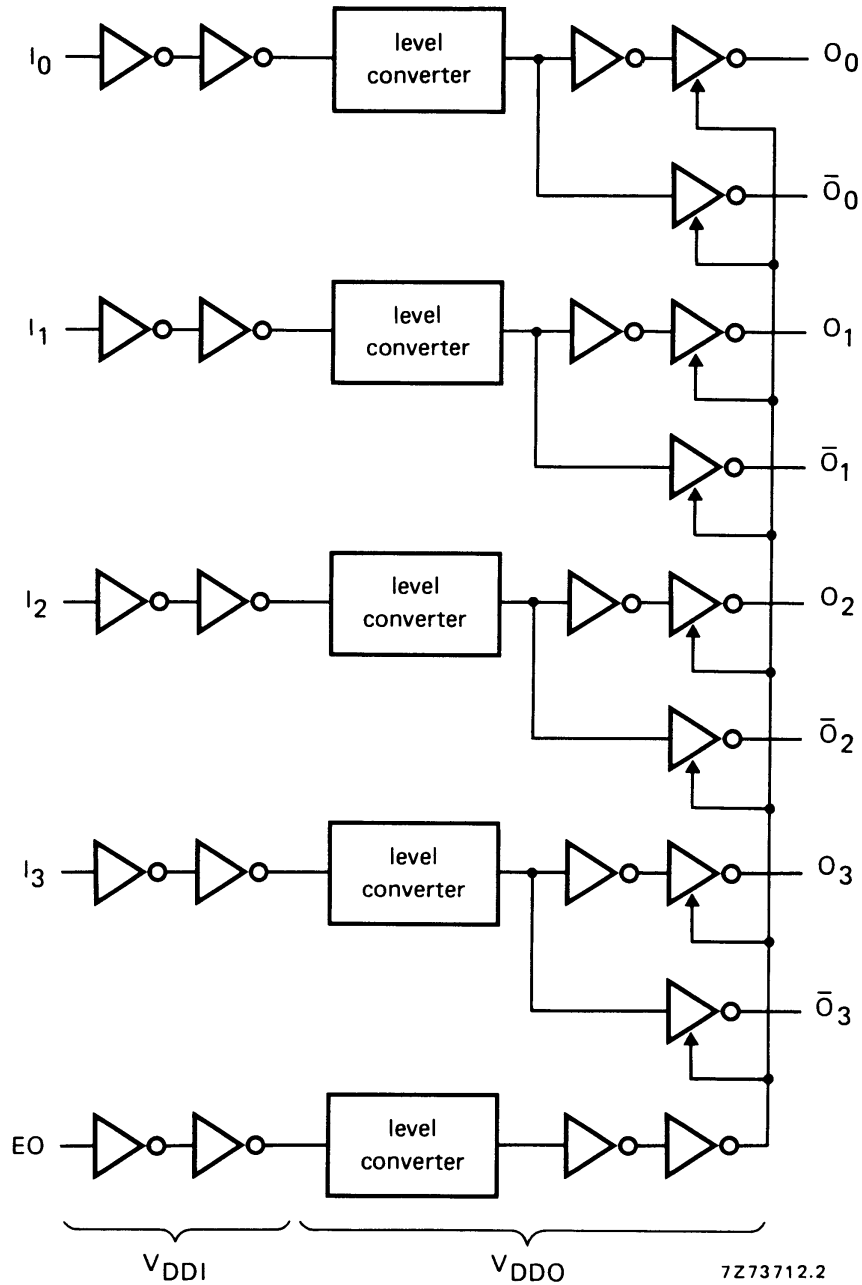


Fig.3 Logic diagram.

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### AC CHARACTERISTICS

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

	$V_{DD}$ V	SYMBOL	TYP.	MAX.		TYPICAL EXTRAPOLATION FORMULA		
Propagation delays $I_n \rightarrow O_n, \bar{O}_n$ HIGH to LOW	5	$t_{PHL}$	170	340	ns	143 ns + (0,55 ns/pF) $C_L$		
	10		80	160	ns	69 ns + (0,23 ns/pF) $C_L$		
	15		65	135	ns	57 ns + (0,16 ns/pF) $C_L$		
	LOW to HIGH	5	$t_{PLH}$	170	340	ns	143 ns + (0,55 ns/pF) $C_L$	
		10		80	160	ns	69 ns + (0,23 ns/pF) $C_L$	
		15		70	140	ns	62 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) $C_L$		
	LOW to HIGH	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) $C_L$	
3-state propagation delays Output disable times $EO \rightarrow O_n, \bar{O}_n$ HIGH	5	$t_{PHZ}$	70	135	ns			
	10		55	110	ns			
	15		60	120	ns			
	LOW	5	$t_{PLZ}$	70	135	ns		
		10		55	105	ns		
		15		55	110	ns		
	Output enable times $EO \rightarrow O_n, \bar{O}_n$ HIGH	5	$t_{PZH}$	195	395	ns		
		10		95	195	ns		
		15		80	165	ns		
		LOW	5	$t_{PZL}$	195	395	ns	
			10		95	190	ns	
			15		80	160	ns	

	$V_{DD}$ V	TYPICAL FORMULA FOR P ( $\mu$ W)	
Dynamic power dissipation per package (P)	5	$3\,000 f_i + \sum (f_o C_L) \times V_{DD}^2$	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)
	10	$12\,200 f_i + \sum (f_o C_L) \times V_{DD}^2$	
	15	$31\,000 f_i + \sum (f_o C_L) \times V_{DD}^2$	

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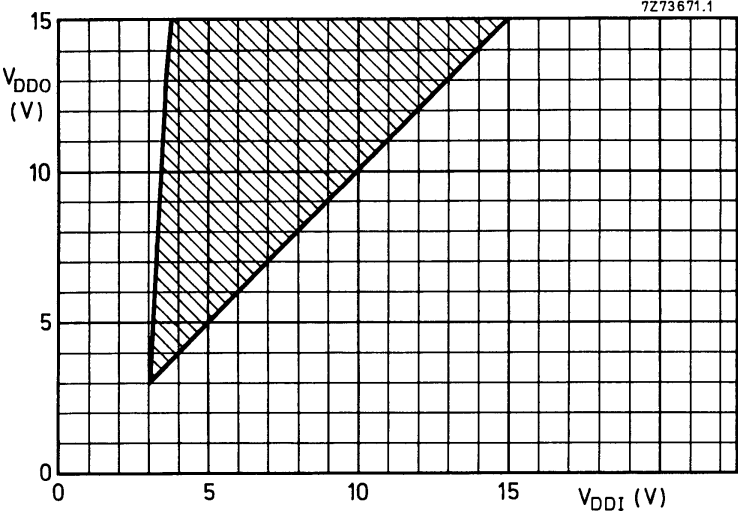


Fig.4  $V_{DDO}$  as a function of  $V_{DDI}$ ; the shaded area shows the permissible operating range.