

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

HEF4076B

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Quadruple D-type register with 3-state outputs

Product specification
File under Integrated Circuits, IC04

January 1995

Quadruple D-type register with 3-state outputs

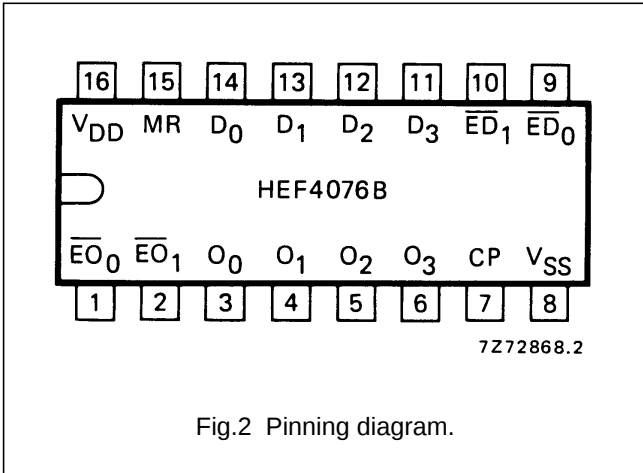
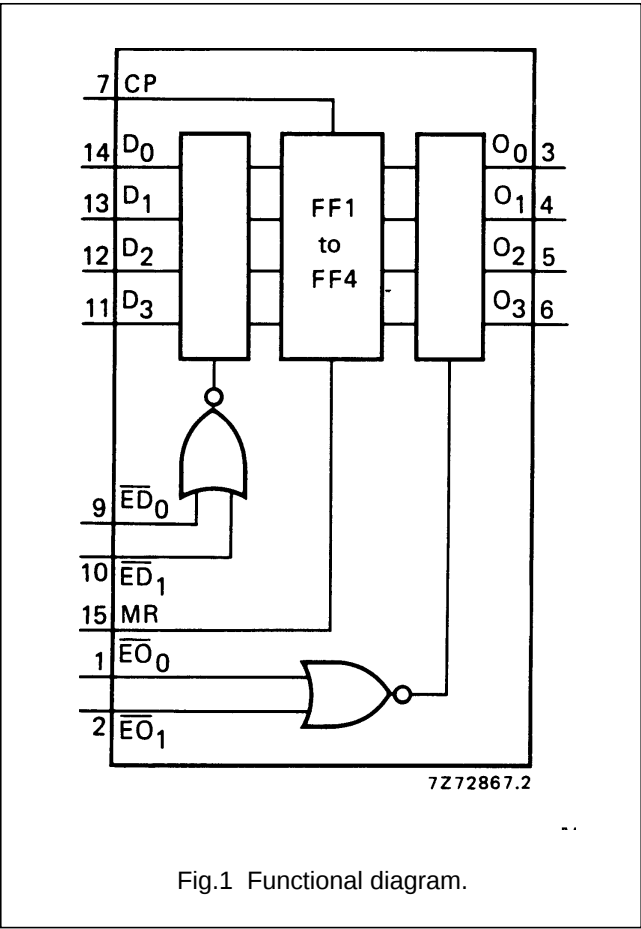
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DESCRIPTION

The HEF4076B is a quadruple edge-triggered D-type flip-flop with four data inputs (D_0 to D_3), two active LOW data enable inputs ($\overline{ED}_0$ and $\overline{ED}_1$), a common clock input (CP), four 3-state outputs (O_0 to O_3), two active LOW output enable inputs ($\overline{EO}_0$ and $\overline{EO}_1$), and an overriding asynchronous master reset input (MR).

Information on D_0 to D_3 is stored in the four flip-flops on the LOW to HIGH transition of CP if both $\overline{ED}_0$ and $\overline{ED}_1$ are LOW. A HIGH on either $\overline{ED}_0$ or $\overline{ED}_1$ prevents the flip-flops from changing on the LOW to HIGH transition of CP, independent of the information on D_0 to D_3 . When both $\overline{EO}_0$ and $\overline{EO}_1$ are LOW, the contents of the four flip-flops are available at O_0 to O_3 . A HIGH on either $\overline{EO}_0$ or $\overline{EO}_1$ forces O_0 to O_3 into the high impedance OFF-state. A HIGH on MR resets all four flip-flops, independent of all other input conditions.



PINNING

- D_0 to D_3 data inputs
- $\overline{ED}_0$, $\overline{ED}_1$ data enable inputs (active LOW)
- $\overline{EO}_0$, $\overline{EO}_1$ output enable inputs (active LOW)
- CP clock input (LOW to HIGH, edge-triggered)
- MR master reset input
- O_0 to O_3 data outputs

FAMILY DATA, I_{DD} LIMITS category MSI

See Family Specifications

Quadruple D-type register with 3-state outputs

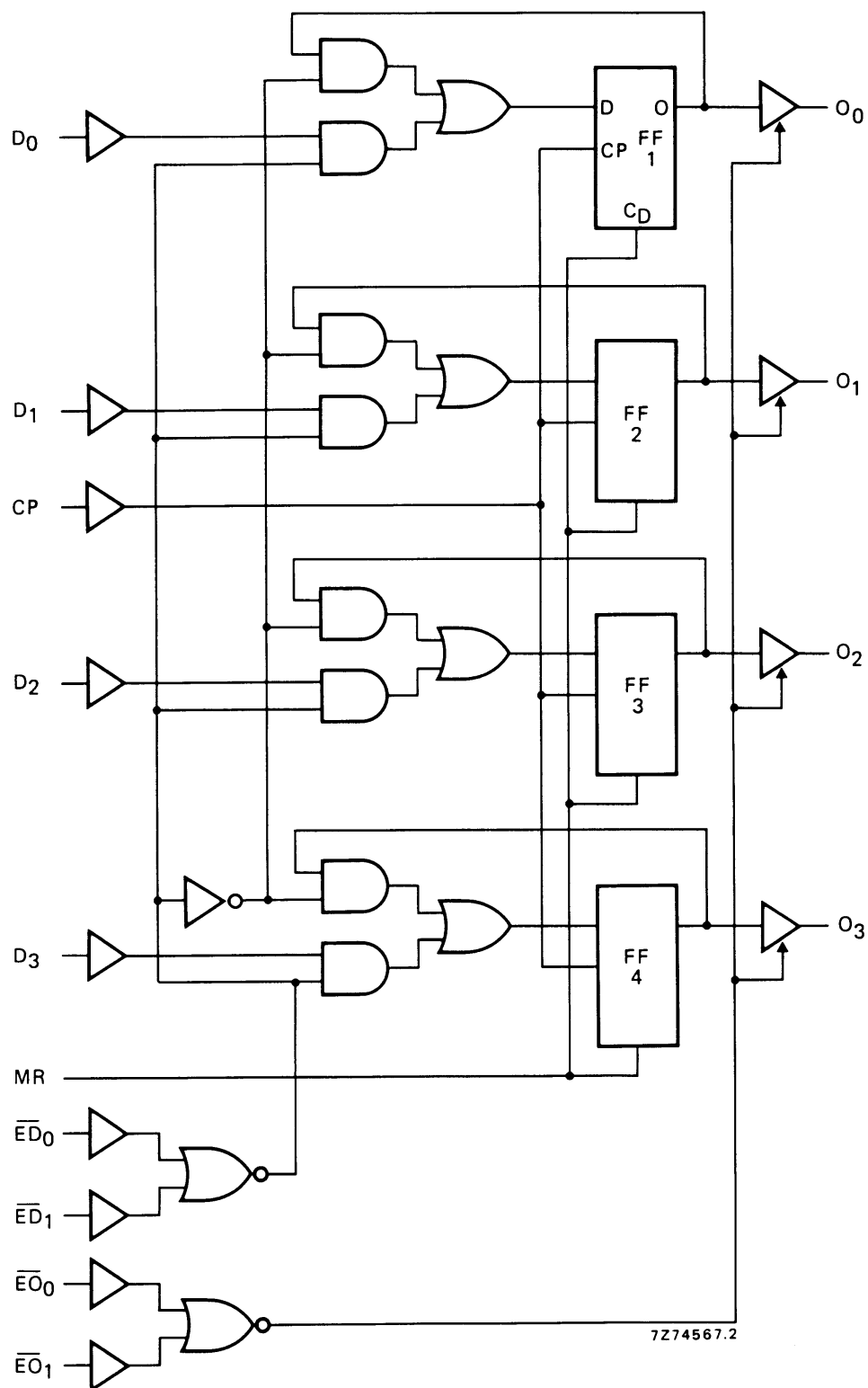
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Fig.3 Logic diagram.

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FUNCTION TABLE

INPUTS					OUTPUTS
MR	CP	$\overline{ED}_0$	$\overline{ED}_1$	D_n	O_n
H	X	X	X	X	L
L	$\nearrow$	H	X	X	no change
L	$\nearrow$	X	H	X	no change
L	$\nearrow$	L	L	H	H
L	$\nearrow$	L	L	L	L
L	$\searrow$	X	X	X	no change

Notes

1. $\overline{EO}_0 = \overline{EO}_1 = \text{LOW}$ When either $\overline{EO}_0$ or $\overline{EO}_1$ is HIGH, the outputs are disabled (high impedance OFF-state).

H = HIGH state (the more positive voltage)

L = LOW state (the less positive voltage)

X = state is immaterial

 $\nearrow$ = positive-going transition $\searrow$ = negative-going transition

AC CHARACTERISTICS

 $V_{SS} = 0 \text{ V}$; $T_{amb} = 25^\circ\text{C}$; $C_L = 50 \text{ pF}$; input transition times $\leq 20 \text{ ns}$; see also waveforms Fig.4

	V_{DD} V	SYMBOL	MIN.	TYP.	MAX.	TYPICAL EXTRAPOLATION FORMULA
Propagation delays						
CP $\rightarrow$ O_n	5			150	305 ns	123 ns + (0,55 ns/pF) C_L
HIGH to LOW	10	t_{PHL}		60	120 ns	49 ns + (0,23 ns/pF) C_L
	15			45	85 ns	37 ns + (0,16 ns/pF) C_L
LOW to HIGH	5			160	320 ns	133 ns + (0,55 ns/pF) C_L
	10	t_{PLH}		65	130 ns	54 ns + (0,23 ns/pF) C_L
	15			45	90 ns	37 ns + (0,16 ns/pF) C_L
MR $\rightarrow$ O_n	5			95	190 ns	68 ns + (0,55 ns/pF) C_L
HIGH to LOW	10	t_{PHL}		40	85 ns	29 ns + (0,23 ns/pF) C_L
	15			30	65 ns	22 ns + (0,16 ns/pF) C_L
Output transition times						
HIGH to LOW	5			60	120 ns	10 ns + (1,0 ns/pF) C_L
	10	t_{THL}		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			60	120 ns	10 ns + (1,0 ns/pF) C_L
	10	t_{TLH}		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 times						
Output disable times						
$\overline{EO}_n \rightarrow O_n$	5			50	105 ns	
HIGH	10	t_{PHZ}		35	70 ns	
	15			30	65 ns	
LOW	5			45	90 ns	
	10	t_{PLZ}		30	65 ns	
	15			30	60 ns	

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	V _{DD} V	SYMBOL	MIN.	TYP.	MAX.	TYPICAL EXTRAPOLATION FORMULA
Output enable times $\overline{EO}_n \rightarrow O_n$ HIGH LOW	5	t_{PZH}		65	130 ns	
	10			30	55 ns	
	15			20	40 ns	
	5	t_{PZL}		60	120 ns	
	10			25	50 ns	
	15			20	35 ns	

AC CHARACTERISTICS

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

	V _{DD} V	SYMBOL	MIN.	TYP.	MAX.	TYPICAL EXTRAPOLATION FORMULA
Set-up times D _n → CP $\overline{ED}_n \rightarrow CP$	5	t_{su}	10	−15	ns	see also waveforms Fig.4
	10		0	−10	ns	
	15		0	−5	ns	
	5	t_{su}	0	−50	ns	
	10		0	−20	ns	
	15		0	−15	ns	
Hold times D _n → CP $\overline{ED}_n \rightarrow CP$	5	t_{hold}	55	30	ns	
	10		20	10	ns	
	15		15	10	ns	
	5	t_{hold}	25	−25	ns	
	10		10	−10	ns	
	15		5	−5	ns	
Minimum clock pulse width; LOW	5	t_{WCPL}	120	60	ns	
	10		45	20	ns	
	15		30	15	ns	
Minimum MR pulse width; HIGH	5	t_{WMRH}	55	25	ns	
	10		30	15	ns	
	15		20	10	ns	
Recovery time for MR	5	t_{RMR}	90	45	ns	
	10		35	15	ns	
	15		20	10	ns	
Maximum clock pulse frequency	5	f_{max}	4	8	MHz	
	10		11	22	MHz	
	15		16	32	MHz	

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	V_{DD} V	TYPICAL FORMULA FOR P (μ W)	
Dynamic power dissipation per package (P)	5 10 15	$2200 f_i + \sum (f_o C_L) \times V_{DD}^2$ $9300 f_i + \sum (f_o C_L) \times V_{DD}^2$ $24\,500 f_i + \sum (f_o C_L) \times V_{DD}^2$	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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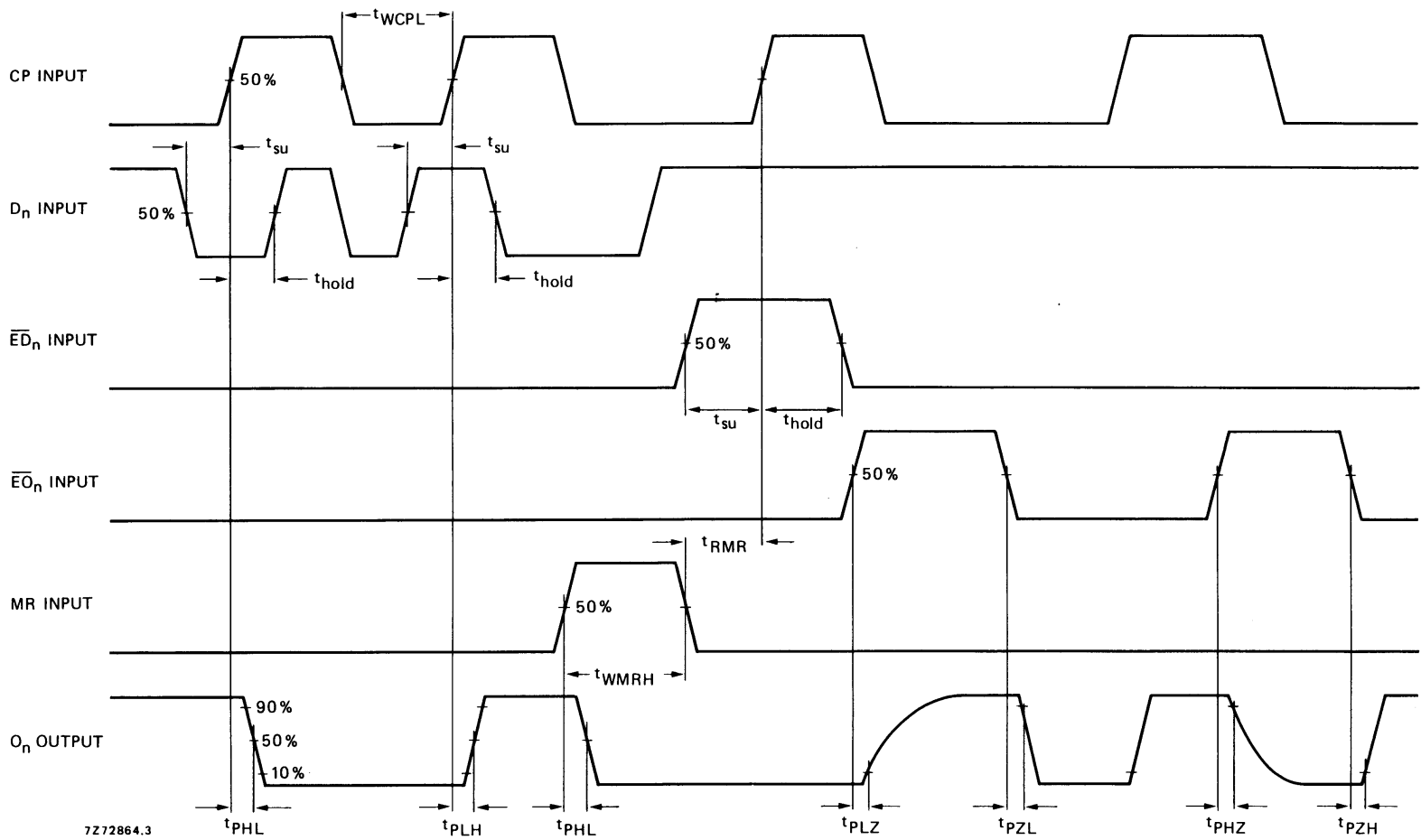


Fig.4 Waveforms showing propagation delays, output disable/enable times, minimum CP and MR pulse widths, set-up and hold times for D_n to CP and $\overline{ED}_n$ to CP, and recovery time for MR. Set-up and hold times are shown as positive values but may be specified as negative values.