

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

HEF4020B

MSI

14-stage binary counter

Product specification
File under Integrated Circuits, IC04

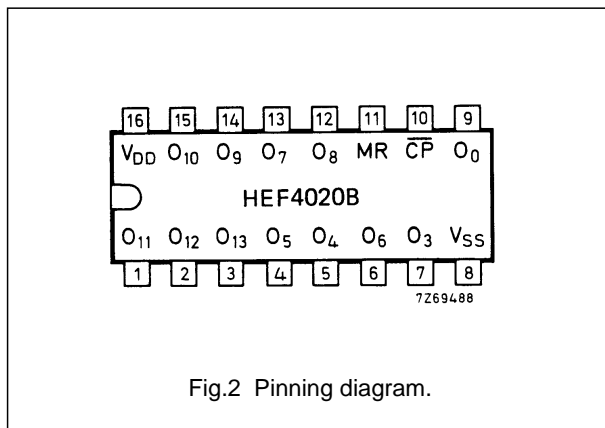
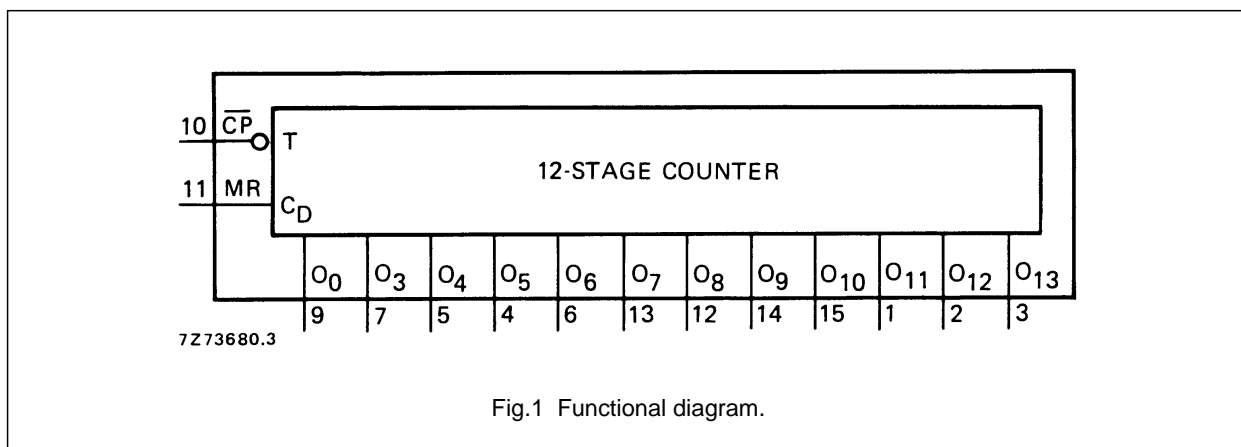
January 1995

14-stage binary counter

HEF4020B MSI

DESCRIPTION

The HEF4020B is a 14-stage binary ripple counter with a clock input (\overline{CP}), an overriding asynchronous master reset input (MR) and twelve fully buffered outputs (O_0 , O_3 to O_{13}). The counter advances on the HIGH to LOW transition of \overline{CP} . A HIGH on MR clears all counter stages and forces all outputs LOW, independent of the state of \overline{CP} . Each counter stage is a static toggle flip-flop. A feature of the HEF4020B is: high speed (typ. 35 MHz at $V_{DD} = 15\text{ V}$).



- HEF4020BP(N): 16-lead DIL; plastic (SOT38-1)
 - HEF4020BD(F): 16-lead DIL; ceramic (cerdip) (SOT74)
 - HEF4020BT(D): 16-lead SO; plastic (SOT109-1)
- (): Package Designator North America

PINNING

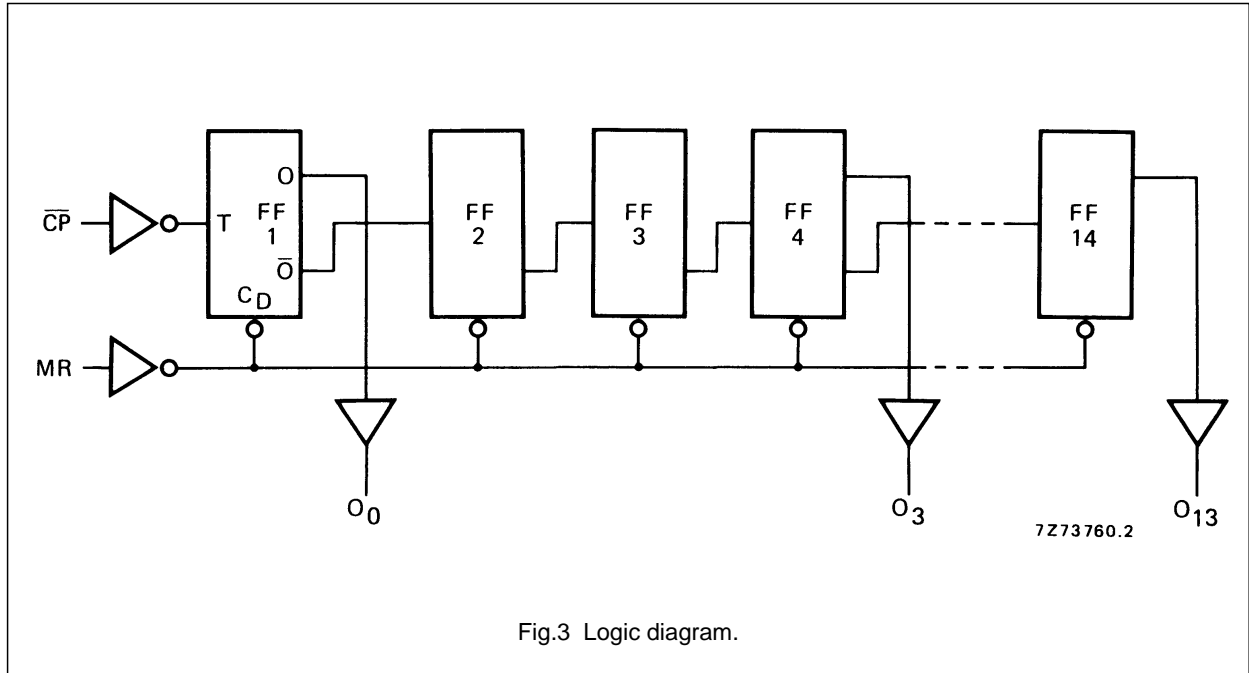
- \overline{CP} clock input (HIGH to LOW edge triggered)
- MR master reset input (active HIGH)
- O_0, O_3 to O_{13} parallel outputs

FAMILY DATA, I_{DD} LIMITS category MSI

See Family Specifications

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

	V_{DD} V	SYMBOL	MIN.	TYP.	MAX.	TYPICAL EXTRAPOLATION FORMULA		
Propagation delays $\overline{CP} \rightarrow O_0$ HIGH to LOW	5	t_{PHL}		105	210	ns	$78\text{ ns} + (0,55\text{ ns/pF}) C_L$	
	10		45	90	ns	$34\text{ ns} + (0,23\text{ ns/pF}) C_L$		
	15		30	65	ns	$22\text{ ns} + (0,16\text{ ns/pF}) C_L$		
	LOW to HIGH	5	t_{PLH}		105	210	ns	$78\text{ ns} + (0,55\text{ ns/pF}) C_L$
		10		50	95	ns	$39\text{ ns} + (0,23\text{ ns/pF}) C_L$	
		15		35	70	ns	$27\text{ ns} + (0,16\text{ ns/pF}) C_L$	
$O_n \rightarrow O_{n+1}$ HIGH to LOW	5	t_{PHL}		80	160	ns	$53\text{ ns} + (0,55\text{ ns/pF}) C_L$	
	10		30	60	ns	$19\text{ ns} + (0,23\text{ ns/pF}) C_L$		
	15		20	40	ns	$12\text{ ns} + (0,16\text{ ns/pF}) C_L$		
	LOW to HIGH	5	t_{PLH}		70	140	ns	$43\text{ ns} + (0,55\text{ ns/pF}) C_L$
		10		25	50	ns	$14\text{ ns} + (0,23\text{ ns/pF}) C_L$	
		15		20	40	ns	$12\text{ ns} + (0,16\text{ ns/pF}) C_L$	
MR $\rightarrow O_n$ HIGH to LOW	5	t_{PHL}		180	360	ns	$153\text{ ns} + (0,55\text{ ns/pF}) C_L$	
	10		90	180	ns	$79\text{ ns} + (0,23\text{ ns/pF}) C_L$		
	15		70	140	ns	$62\text{ ns} + (0,16\text{ ns/pF}) C_L$		
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	$6\text{ ns} + (0,28\text{ ns/pF}) C_L$	
Minimum clock pulse width; HIGH	5	t_{WCPH}	50	25		ns		
	10		25	15		ns		
	15		20	10		ns		
Minimum MR pulse width; HIGH	5	t_{WMRH}	130	65		ns		
	10		95	50		ns		
	15		90	45		ns		
Recovery time for MR	5	t_{RMR}	115	60		ns		
	10		65	35		ns		
	15		55	25		ns		
Maximum clock pulse frequency	5	f_{max}	5	10		MHz		
	10		13	25		MHz		
	15		18	35		MHz		

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	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 cap. (pF) $\sum (f_o C_L)$ = sum of outputs V_{DD} = supply voltage (V)
	10	$2\,800 f_i + \sum (f_o C_L) \times V_{DD}^2$	
	15	$8\,200 f_i + \sum (f_o C_L) \times V_{DD}^2$	

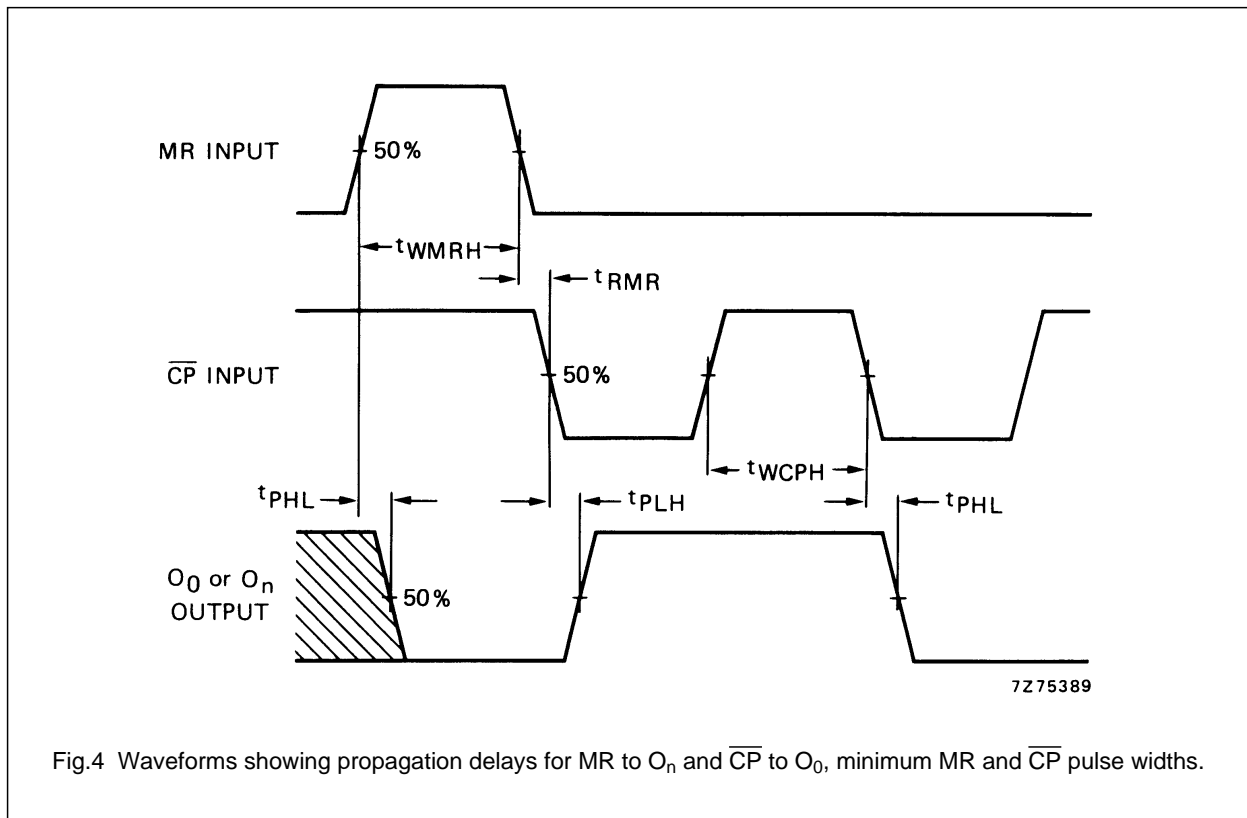


Fig.4 Waveforms showing propagation delays for MR to O_n and CP to O₀, minimum MR and CP pulse widths.

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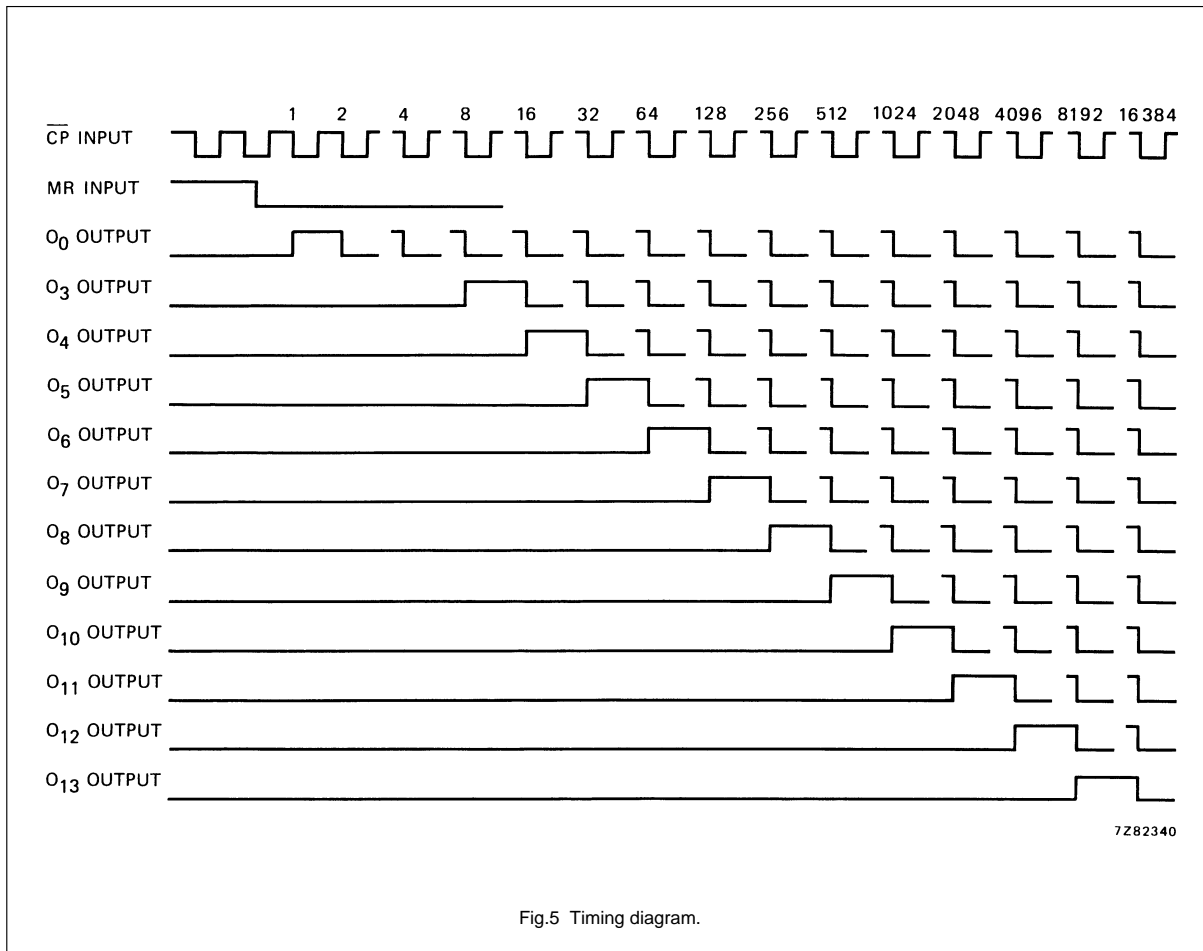


Fig.5 Timing diagram.