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

HEF4027B
flip-flops
Dual JK flip-flop

Product specification
File under Integrated Circuits, IC04

January 1995

Philips Semiconductors

PHILIPS

Dual JK flip-flop

HEF4027B flip-flops

DESCRIPTION

The HEF4027B is a dual JK flip-flop which is edge-triggered and features independent set direct (S_D), clear direct (C_D), clock (CP) inputs and outputs (O,$\overline{O}$). Data is accepted when CP is LOW, and transferred to the output on the positive-going edge of the clock. The active HIGH asynchronous clear-direct (C_D) and set-direct (S_D) are independent and override the J, K, and CP inputs. The outputs are buffered for best system performance. Schmitt-trigger action in the clock input makes the circuit highly tolerant to slower clock rise and fall times.

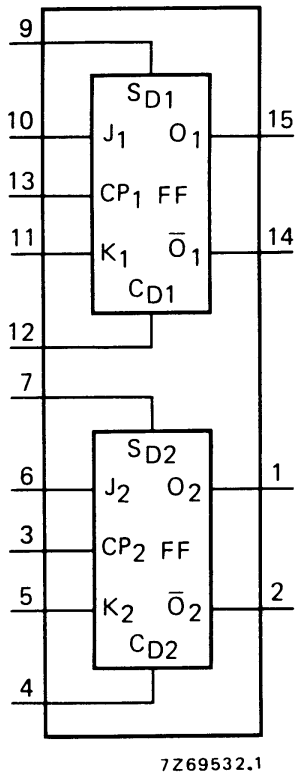


Fig.1 Functional diagram.

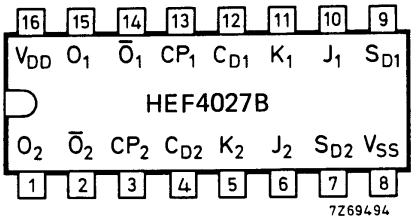


Fig.2 Pinning diagram.

FUNCTION TABLES

INPUTS					OUTPUTS	
S_D	C_D	CP	J	K	O	$\overline{O}$
H	L	X	X	X	H	L
L	H	X	X	X	L	H
H	H	X	X	X	H	H

INPUTS					OUTPUTS	
S_D	C_D	CP	J	K	O_{n+1}	$\overline{O}_{n+1}$
L	L	↗	L	L	no change	
L	L	↗	H	L	H	L
L	L	↗	L	H	L	H
L	L	↗	H	H	$\overline{O}_n$	O_n

Notes

1. H = HIGH state (the more positive voltage)
   L = LOW state (the less positive voltage)
   X = state is immaterial
   ↗ = positive-going transition
   O_{n+1} = state after clock positive transition

PINNING

J,K	synchronous inputs
CP	clock input (L to H edge-triggered)
S_D	asynchronous set-direct input (active HIGH)
C_D	asynchronous clear-direct input (active HIGH)
O	true output
$\overline{O}$	complement output

HEF4027BP(N): 16-lead DIL; plastic (SOT38-1)
HEF4027BD(F): 16-lead DIL; ceramic (cerdip) (SOT74)
HEF4027BT(D): 16-lead SO; plastic (SOT109-1)
( ): Package Designator North America

FAMILY DATA, I_{DD} LIMITS category FLIP-FLOPS

See Family Specifications

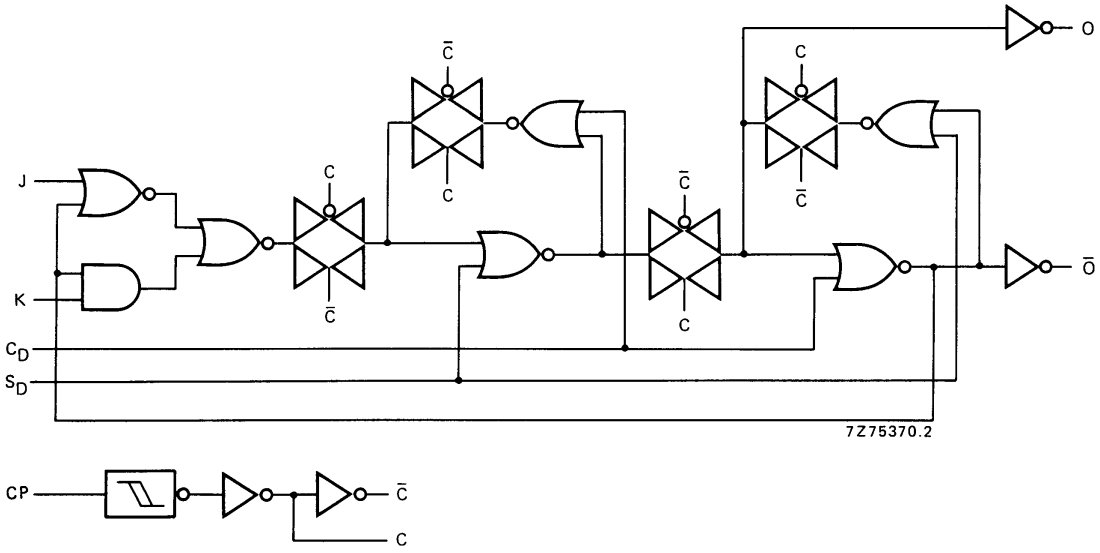


Fig.3 Logic diagram (one flip-flop).

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
Propagation delays						
CP → O, $\overline{O}$	5			105	210 ns	78 ns + (0,55 ns/pF) C_L
HIGH to LOW	10	t_{PHL}		40	80 ns	29 ns + (0,23 ns/pF) C_L
	15			30	60 ns	22 ns + (0,16 ns/pF) C_L
	5			85	170 ns	58 ns + (0,55 ns/pF) C_L
LOW to HIGH	10	t_{PLH}		35	70 ns	27 ns + (0,23 ns/pF) C_L
	15			30	60 ns	22 ns + (0,16 ns/pF) C_L
S_D → O	5			70	140 ns	43 ns + (0,55 ns/pF) C_L
LOW to HIGH	10	t_{PLH}		30	60 ns	19 ns + (0,23 ns/pF) C_L
	15			25	50 ns	17 ns + (0,16 ns/pF) C_L
C_D → O	5			120	240 ns	93 ns + (0,55 ns/pF) C_L
HIGH to LOW	10	t_{PHL}		45	90 ns	33 ns + (0,23 ns/pF) C_L
	15			35	70 ns	27 ns + (0,16 ns/pF) C_L
S_D → $\overline{O}$	5			140	280 ns	113 ns + (0,55 ns/pF) C_L
HIGH to LOW	10	t_{PHL}		55	110 ns	44 ns + (0,23 ns/pF) C_L
	15			40	80 ns	32 ns + (0,16 ns/pF) C_L

	V_{DD} V	SYMBOL	MIN.	TYP.	MAX.		TYPICAL EXTRAPOLATION FORMULA
$C_D \rightarrow \overline{O}$	5			75	150	ns	48 ns + (0,55 ns/pF) C_L
LOW to HIGH	10	t_{PLH}		35	70	ns	24 ns + (0,23 ns/pF) C_L
	15			25	50	ns	17 ns + (0,16 ns/pF) C_L
Output transition times	5			60	120	ns	10 ns + (1,0 ns/pF) C_L
HIGH to LOW	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
	5			60	120	ns	10 ns + (1,0 ns/pF) C_L
LOW to HIGH	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
Set-up time	5		50	25		ns	see also waveforms Figs 4 and 5
J,K $\rightarrow$ CP	10	t_{su}	30	10		ns	
	15		20	5		ns	
Hold time	5		25	0		ns	
J,K $\rightarrow$ CP	10	t_{hold}	20	0		ns	
	15		15	5		ns	
Minimum clock	5		80	40		ns	
pulse width; LOW	10	t_{WCPL}	30	15		ns	
	15		24	12		ns	
Minimum S_D, C_D	5		90	45		ns	
pulse width; HIGH	10	t_{WSDH}, t_{WCDH}	40	20		ns	
	15		30	15		ns	
Recovery time	5		20	–15		ns	
for S_D, C_D	10	t_{RSD}, t_{RCD}	15	–10		ns	
	15		10	–5		ns	
Maximum clock	5		4	8		MHz	see also waveforms Fig.4
pulse frequency	10	f_{max}	12	25		MHz	
J = K = HIGH	15		15	30		MHz	

	V_{DD} V	TYPICAL FORMULA FOR P (μW)	
Dynamic power	5	$900\ f_i + \sum (f_o C_L) \times V_{DD}^2$	where
dissipation per	10	$4\ 500\ f_i + \sum (f_o C_L) \times V_{DD}^2$	f_i = input freq. (MHz)
package (P)	15	$13\ 200\ f_i + \sum (f_o C_L) \times V_{DD}^2$	f_o = output freq. (MHz)
			C_L = load capacitance (pF)
			$\sum (f_o C_L)$ = sum of outputs
			V_{DD} = supply voltage (V)

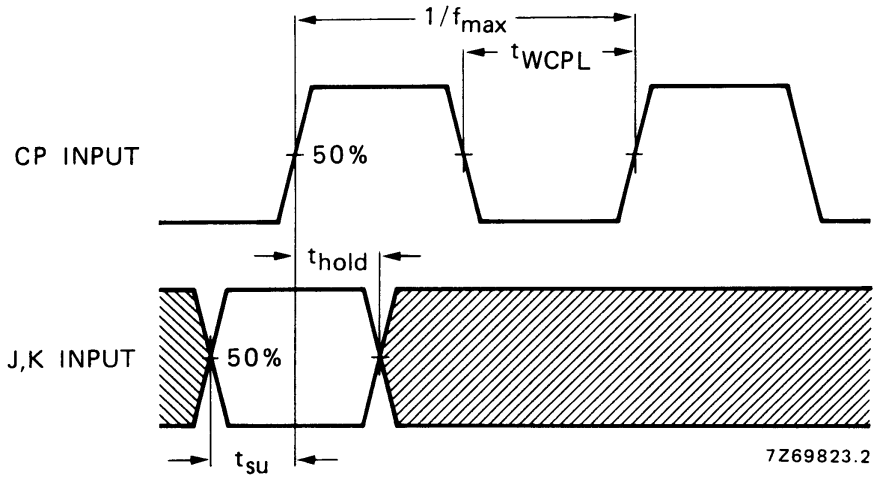


Fig.4 Waveforms showing set-up times, hold times and minimum clock pulse width. Set-up and hold times are shown as positive values but may be specified as negative values.

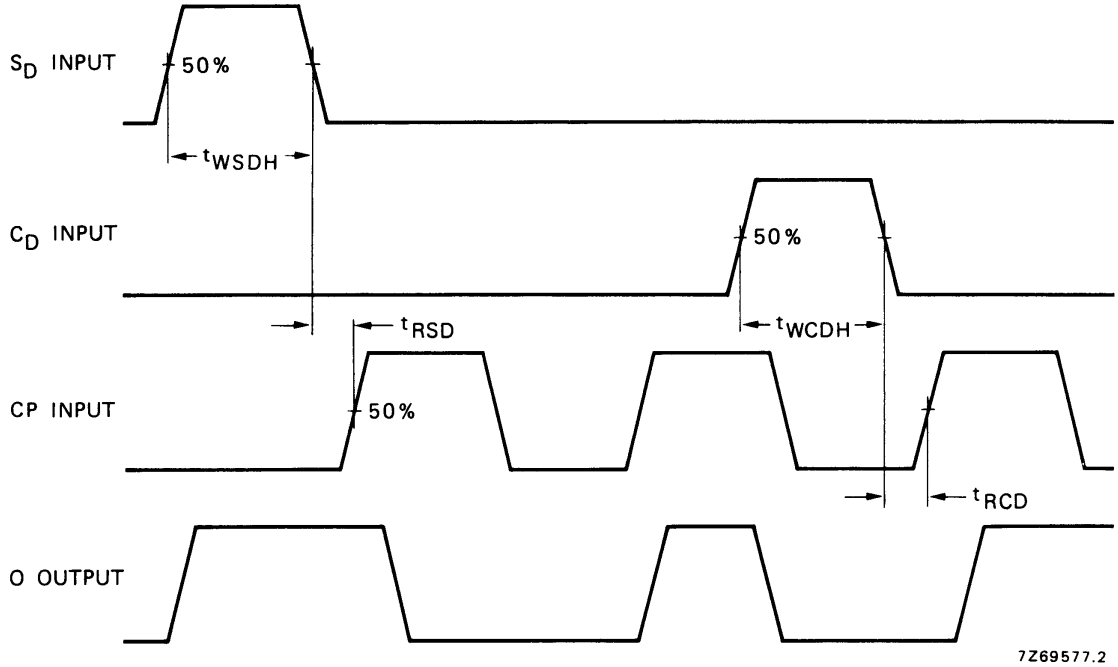


Fig.5 Waveforms showing recovery times for S_D and C_D; minimum S_D and C_D pulse widths.

APPLICATION INFORMATION

Some examples of applications for the HEF4027B are:

- Registers
- Counters
- Control circuits