

# 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

## **HEF4015B**

### **MSI**

## **Dual 4-bit static shift register**

Product specification  
File under Integrated Circuits, IC04

January 1995

# Dual 4-bit static shift register

# HEF4015B MSI

### DESCRIPTION

The HEF4015B is a dual edge-triggered 4-bit static shift register (serial-to-parallel converter). Each shift register has a serial data input (D), a clock input (CP), four fully buffered parallel outputs (O<sub>0</sub> to O<sub>3</sub>) and an overriding asynchronous master reset input (MR). Information

present on D is shifted to the first register position, and all the data in the register is shifted one position to the right on the LOW-to-HIGH transition of CP. A HIGH on MR clears the register and forces O<sub>0</sub> to O<sub>3</sub> to LOW, independent of CP and D. Schmitt-trigger action in the clock input makes the circuit highly tolerant to slower clock rise and fall times.

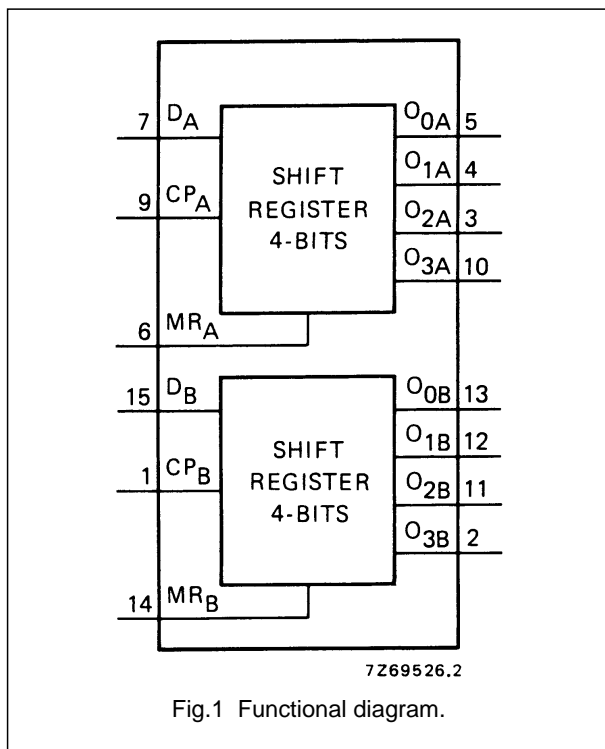


Fig.1 Functional diagram.

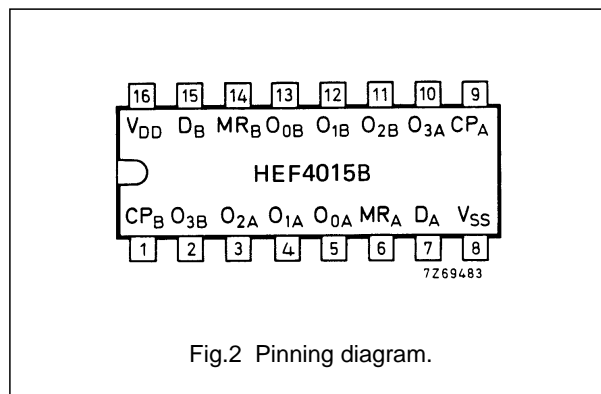


Fig.2 Pinning diagram.

### PINNING

- DA, DB                    serial data input
- MRA, MRB                master reset input (active HIGH)
- CPA, CPB                clock input (LOW-to-HIGH edge-triggered)
- O0A, O1A, O2A, O3A    parallel outputs
- O0B, O1B, O2B, O3B    parallel outputs

### APPLICATION INFORMATION

Some examples of applications for the HEF4015B are:

- Serial-to-parallel converter
- Buffer stores
- General purpose register

### FAMILY DATA, I<sub>DD</sub> LIMITS category MSI

See Family Specifications

- HEF4015BP(N):        16-lead DIL; plastic (SOT38-1)
- HEF4015BD(F):        16-lead DIL; ceramic (cerdip) (SOT74)
- HEF4015BT(D):        16-lead SO; plastic (SOT109-1)
- ( ): Package Designator North America

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## LOGIC DIAGRAM (one register)

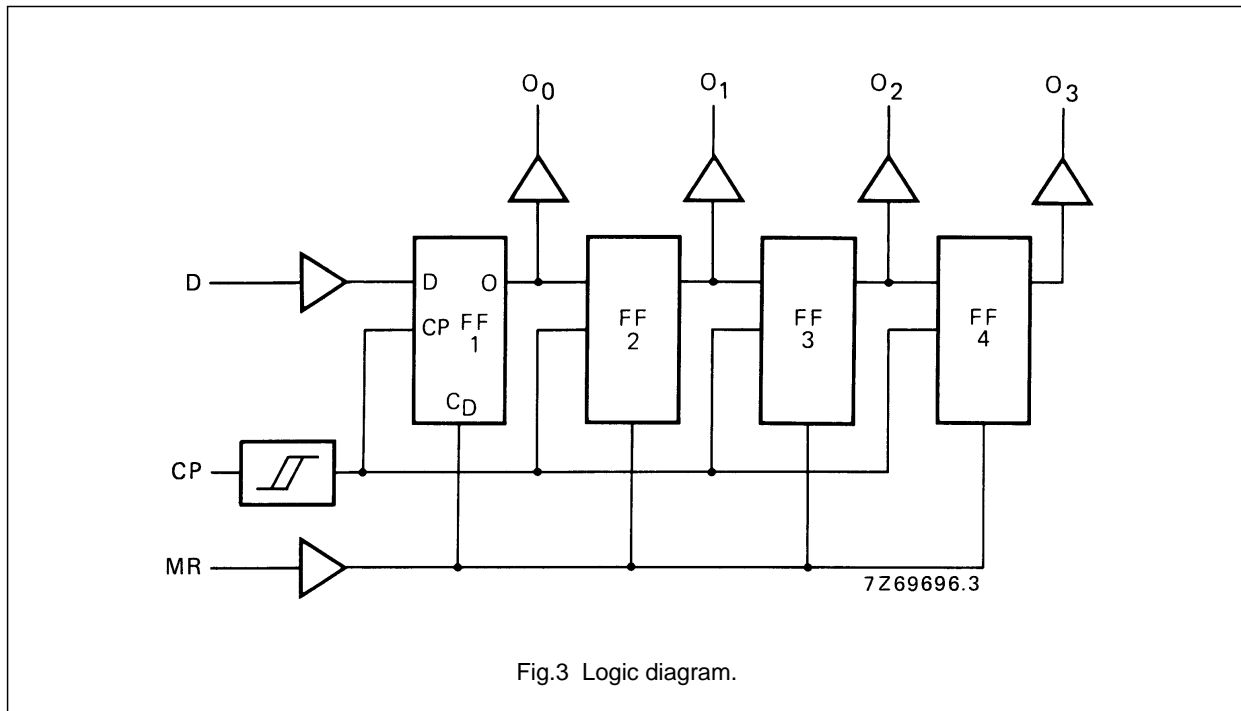


Fig.3 Logic diagram.

## FUNCTION TABLE

n	INPUTS			OUTPUTS			
	CP	D	MR	O <sub>0</sub>	O <sub>1</sub>	O <sub>2</sub>	O <sub>3</sub>
1		D <sub>1</sub>	L	D <sub>1</sub>	X	X	X
2		D <sub>2</sub>	L	D <sub>2</sub>	D <sub>1</sub>	X	X
3		D <sub>3</sub>	L	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	X
4		D <sub>4</sub>	L	D <sub>4</sub>	D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>
		X	L	no change			
	X	X	H	L	L	L	L

## Note

1. H = HIGH state (the more positive voltage)
2. L = LOW state (the less positive voltage)
3. X = state is immaterial
4. = positive-going transition
5. = negative-going transition
6. D<sub>n</sub> = either HIGH or LOW
7. n = number of clock pulse transitions

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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  $\leq 20\text{ ns}$ 

	$V_{DD}$ V	SYMBOL	MIN.	TYP.	MAX.	TYPICAL EXTRAPOLATION FORMULA	
Propagation delays CP $\rightarrow$ $O_n$ HIGH to LOW	5	$t_{PHL}$		130	260	ns	$103\text{ ns} + (0,55\text{ ns/pF}) C_L$
	10			55	110	ns	$44\text{ ns} + (0,23\text{ ns/pF}) C_L$
	15			40	80	ns	$32\text{ ns} + (0,16\text{ ns/pF}) C_L$
LOW to HIGH	5	$t_{PLH}$		120	240	ns	$93\text{ ns} + (0,55\text{ ns/pF}) C_L$
	10			55	110	ns	$44\text{ ns} + (0,23\text{ ns/pF}) C_L$
	15			40	80	ns	$32\text{ ns} + (0,16\text{ ns/pF}) C_L$
MR $\rightarrow$ $O_n$ 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			35	70	ns	$27\text{ ns} + (0,16\text{ ns/pF}) C_L$
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	$6\text{ ns} + (0,28\text{ ns/pF}) C_L$
Set-up time D $\rightarrow$ CP	5	$t_{su}$	25	-15		ns	see waveforms Figs 4 and 5
	10		25	-10		ns	
	15		20	-5		ns	
Hold time D $\rightarrow$ CP	5	$t_{hold}$	40	20		ns	
	10		20	10		ns	
	15		15	8		ns	
Minimum clock pulse width; LOW	5	$t_{WCPL}$	60	30		ns	
	10		30	15		ns	
	15		20	10		ns	
Minimum MR pulse width; HIGH	5	$t_{WMRH}$	80	40		ns	
	10		30	15		ns	
	15		24	12		ns	
Recovery time for MR	5	$t_{RMR}$	50	20		ns	
	10		30	10		ns	
	15		20	5		ns	
Maximum clock pulse frequency	5	$f_{max}$	7	15		MHz	
	10		15	30		MHz	
	15		22	44		MHz	

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	$V_{DD}$ V	TYPICAL FORMULA FOR P ( $\mu$ W)	
Dynamic power dissipation per package (P)	5	$1\ 500 f_i + \sum (f_o C_L) \times V_{DD}^2$	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)
	10	$6\ 300 f_i + \sum (f_o C_L) \times V_{DD}^2$	
	15	$17\ 000 f_i + \sum (f_o C_L) \times V_{DD}^2$	

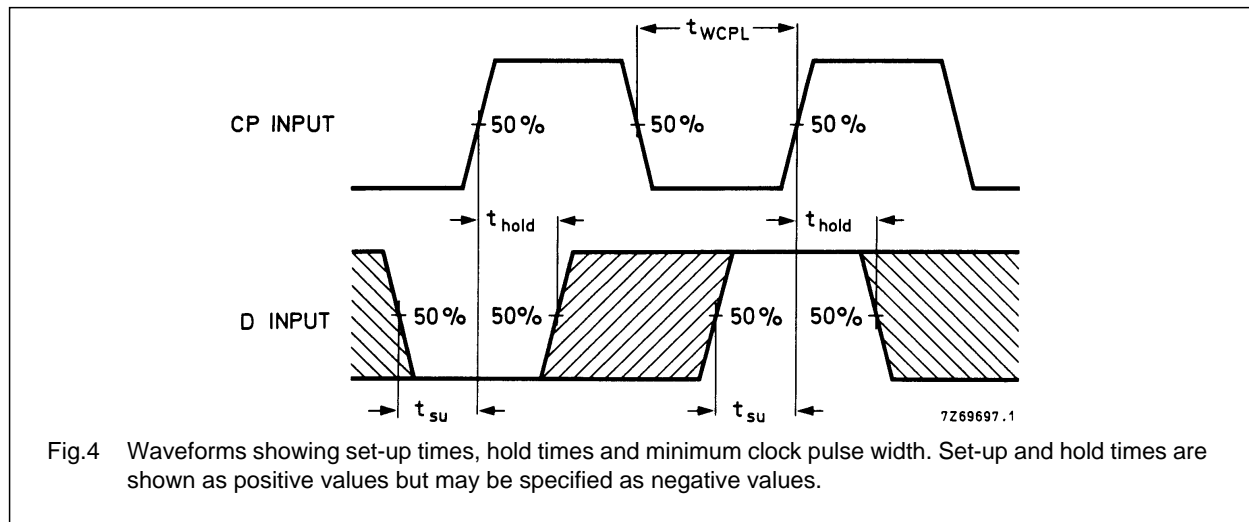


Fig.4 Waveforms showing set-up times, hold times and minimum clock pulse width. Set-up and hold times are shown as positive values but may be specified as negative values.

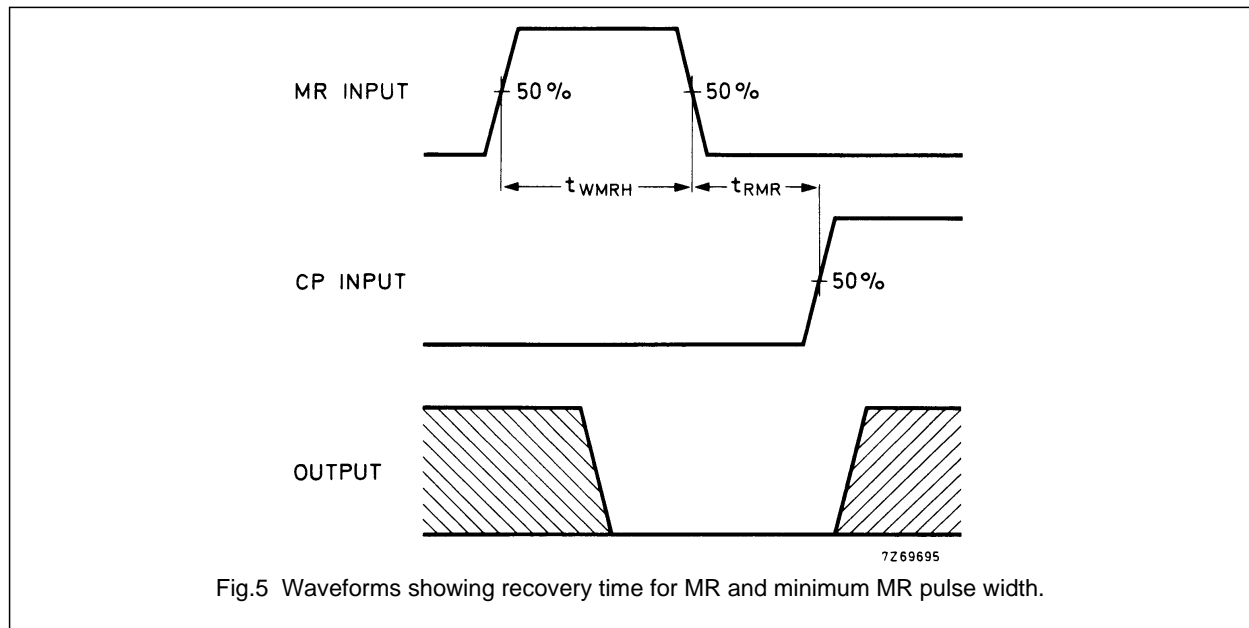


Fig.5 Waveforms showing recovery time for MR and minimum MR pulse width.