

DATA SHEET

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- The IC04 LOC莫斯 HE4000B Logic Family Specifications HEF, HEC
- The IC04 LOC莫斯 HE4000B Logic Package Outlines/Information HEF, HEC

HEF40194B MSI 4-bit bidirectional universal shift register

Product specification
File under Integrated Circuits, IC04

January 1995

4-bit bidirectional universal shift register

HEF40194B
MSI**DESCRIPTION**

The HEF40194B is a 4-bit bidirectional shift register with two mode control inputs (S_0 and S_1), a clock input (CP), a serial data shift left input (D_{SL}), a serial data shift right input (D_{SR}), four parallel data inputs (P_0 to P_3), an overriding asynchronous master reset input (\overline{MR}), and four buffered parallel outputs (O_0 to O_3). When LOW, \overline{MR} resets all stages and forces O_0 to O_3 LOW, overriding all other input conditions. When MR is HIGH, the operation mode is controlled by S_0 and S_1 as shown in the function table.

Serial and parallel operation are edge-triggered on the LOW to HIGH transition of CP. The inputs at which the data are to be entered and S_0 , S_1 must be stable for a set-up time before the LOW to HIGH transition of CP.

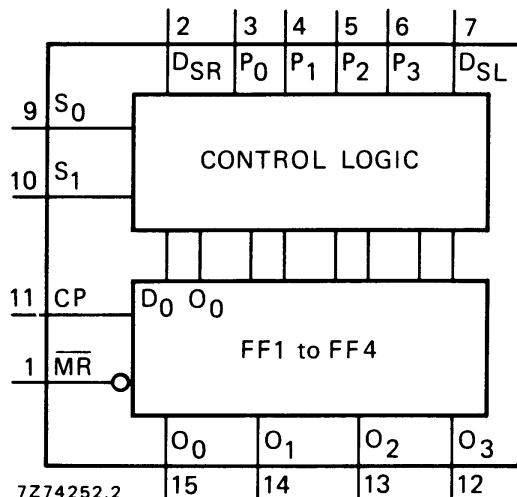


Fig.1 Functional diagram.

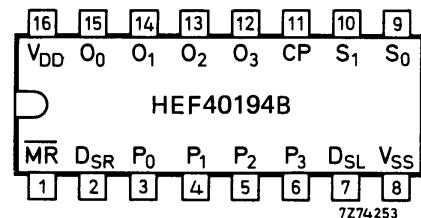


Fig.2 Pinning diagram.

- HEF40194BP(N): 16-lead DIL; plastic (SOT38-1)
- HEF40194BD(F): 16-lead DIL; ceramic (cerdip) (SOT74)
- HEF40194BT(D): 16-lead SO; plastic (SOT109-1)
- (): Package Designator North America

PINNING

- S_0, S_1 mode control inputs
- P_0 to P_3 parallel data inputs
- D_{SR} serial data shift right input
- D_{SL} serial data shift left input
- CP clock input (LOW to HIGH edge-triggered)
- \overline{MR} master reset input (active LOW)
- O_0 to O_3 buffered parallel outputs

FAMILY DATA, I_{DD} LIMITS category MSI

See Family Specifications

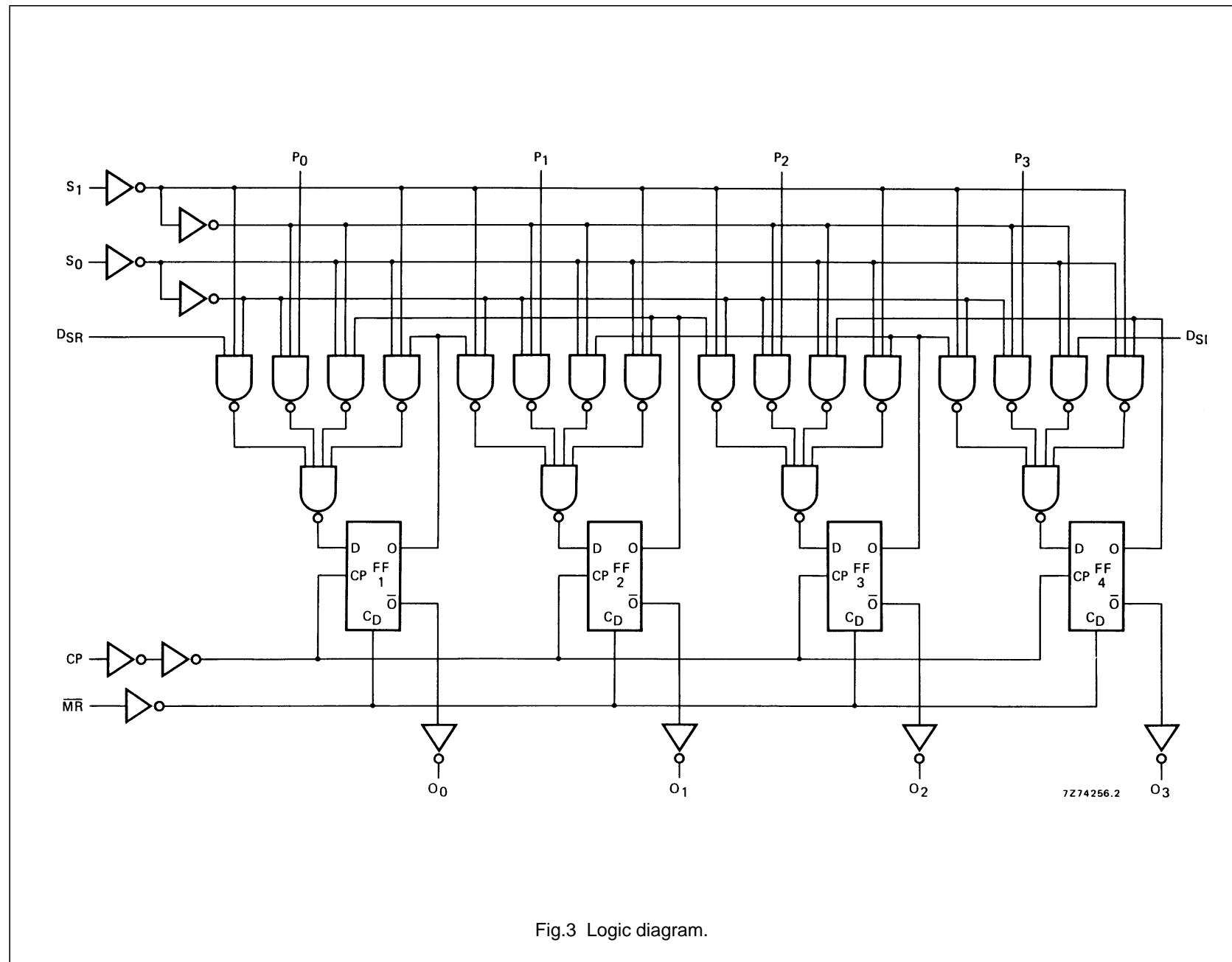


Fig.3 Logic diagram.

4-bit bidirectional universal shift register

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FUNCTION TABLE

OPERATING MODE	INPUTS ($\overline{MR} = \text{HIGH}$)					OUTPUTS AT T_{n+1}			
	S_1	S_0	D_{SR}	D_{SL}	$P_0 \text{ TO } P_3$	O_0	O_1	O_2	O_3
hold	L	L	X	X	X	O_0	O_1	O_2	O_3
shift left	H	L	X	L	X	O_1	O_2	O_3	L
	H	L	X	H	X	O_1	O_2	O_3	H
shift right	L	H	L	X	X	L	O_0	O_1	O_2
	L	H	H	X	X	H	O_0	O_1	O_2
parallel load	H	H	X	X	L	L	L	L	L
	H	H	X	X	H	H	H	H	H

Notes

1. H = HIGH state (the more positive voltage)
2. L = LOW state (the less positive voltage)
3. X = state is immaterial
4. t_{n+1} = state after next LOW to HIGH transition of CP

AC CHARACTERISTICS

 $V_{SS} = 0 \text{ V}$; $T_{amb} = 25^\circ\text{C}$; input transition times $\leq 20 \text{ ns}$

	V_{DD} V	TYPICAL FORMULA FOR P (μW)	
Dynamic power dissipation per package (P)	5	$1\ 500 f_i + \sum (f_o C_L) \times V_{DD}^2$	where
	10	$6\ 900 f_i + \sum (f_o C_L) \times V_{DD}^2$	$f_i = \text{input freq. (MHz)}$
	15	$18\ 900 f_i + \sum (f_o C_L) \times V_{DD}^2$	$f_o = \text{output freq. (MHz)}$ $C_L = \text{load cap. (pF)}$ $\sum (f_o C_L) = \text{sum of outputs}$ $V_{DD} = \text{supply voltage (V)}$

4-bit bidirectional universal shift register

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	V_{DD} V	SYMBOL	MIN.	TYP.	MAX.	TYPICAL EXTRAPOLATION FORMULA
Propagation delays $CP \rightarrow O_n$ HIGH to LOW	5	t _{PHL}	100	205	ns	73 ns + (0,55 ns/pF) C_L
	10		40	85	ns	29 ns + (0,23 ns/pF) C_L
	15		30	60	ns	22 ns + (0,16 ns/pF) C_L
	5	t _{PLH}	80	165	ns	53 ns + (0,55 ns/pF) C_L
	10		35	70	ns	24 ns + (0,23 ns/pF) C_L
	15		25	55	ns	17 ns + (0,16 ns/pF) C_L
$\overline{MR} \rightarrow O_n$ HIGH to LOW	5	t _{PHL}	85	175	ns	58 ns + (0,55 ns/pF) C_L
	10		40	80	ns	29 ns + (0,23 ns/pF) C_L
	15		30	60	ns	22 ns + (0,16 ns/pF) C_L
	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
Output transition times HIGH to LOW	5	t _{TTLH}	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
	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

4-bit bidirectional universal shift register

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	V_{DD} V	SYMBOL	MIN.	TYP.	MAX.	TYPICAL EXTRAPOLATION FORMULA
Set-up times $P_n, D_{SR}, D_{SL} \rightarrow CP$	5	t_{su}	80	40	ns	see also waveforms Figs 4 and 5
	10		30	15	ns	
	15		20	10	ns	
	5 $S_n \rightarrow CP$	t_{su}	140	70	ns	
			60	30	ns	
			40	20	ns	
Hold times $P_n, D_{SR}, D_{SL} \rightarrow CP$	5	t_{hold}	10	-30	ns	see also waveforms Figs 4 and 5
	10		5	-10	ns	
	15		5	-5	ns	
	5 $S_n \rightarrow CP$	t_{hold}	25	-45	ns	
			15	-15	ns	
			10	-10	ns	
Minimum clock pulse width; LOW	5	t_{WCPL}	50	25	ns	see also waveforms Figs 4 and 5
	10		20	10	ns	
	15		20	10	ns	
Minimum \overline{MR} pulse width; LOW	5	t_{WMRL}	80	40	ns	see also waveforms Figs 4 and 5
	10		40	20	ns	
	15		30	15	ns	
Recovery time for \overline{MR}	5	t_{RMR}	30	10	ns	see also waveforms Figs 4 and 5
	10		15	5	ns	
	15		15	5	ns	
Maximum clock pulse frequency	5	f_{max}	6	12	MHz	see also waveforms Figs 4 and 5
	10		15	30	MHz	
	15		20	40	MHz	

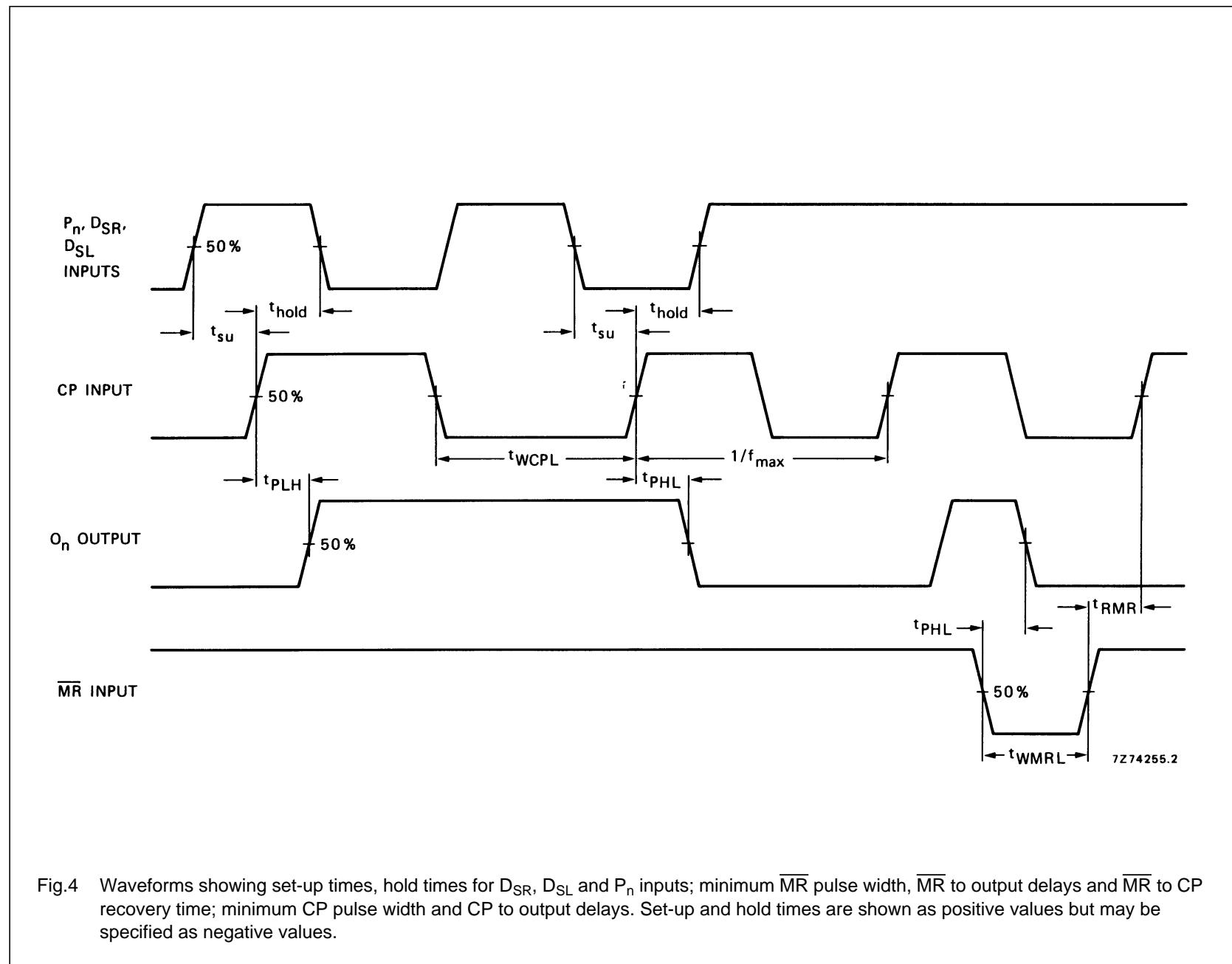


Fig.4 Waveforms showing set-up times, hold times for D_{SR}, D_{SL} and P_n inputs; minimum MR pulse width, MR to output delays and MR to CP recovery time; minimum CP pulse width and CP to output delays. Set-up and hold times are shown as positive values but may be specified as negative values.

4-bit bidirectional universal shift register

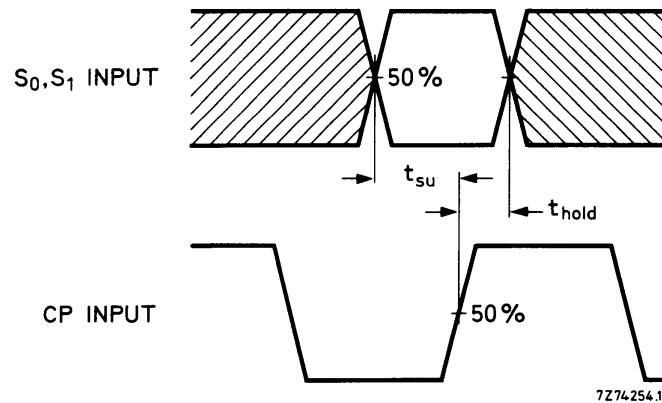
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Fig.5 Waveforms showing set-up times and hold times for S₀ and S₁ inputs. Set-up and hold times are shown as positive values but may be specified as negative values.

APPLICATION INFORMATION

Some examples of applications for the HEF40194B are:

- Arithmetic unit register
- Serial/parallel converter.