

HD74LS95B ● 4-bit Parallel Access Shift Registers

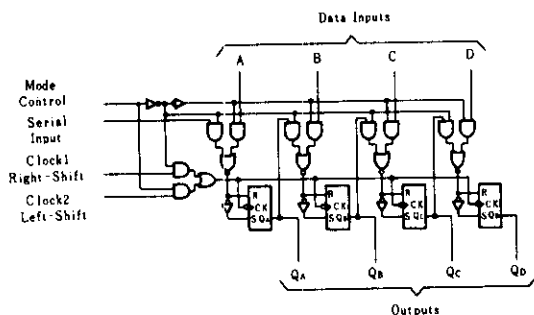
This 4-bit register features parallel and serial inputs, parallel outputs, mode control, and two clock inputs. The register has three mode operation:

- Parallel (broadside) load
- Shift right (the direction Q_A toward Q_D)
- Shift left (the direction Q_D toward Q_A)

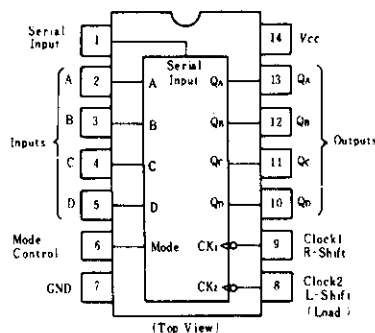
Parallel loading is accomplished by applying the four bits of data and taking the mode control input high. The data is loaded into the associated flip-flops and appears at the outputs after the high-to-low transition of the clock-2 input. During loading, the entry of serial data is inhibited. Shift right is accomplished on the high-to-low transition of clock-1 when the

mode control is low; shift left is accomplished on the high-to-low transition of clock-2 when the mode control is high by connecting the output of each flip-flop to the parallel input of the previous flip-flop (Q_D to input C, etc.) and serial data is entered at input D. The clock input may be applied commonly to clock-1 and clock-2 if both modes can be clocked from the same source. Changes at the mode control input should normally be made while both clock inputs are low; however, conditions described in the last three lines of the function table will also ensure that register contents are protected.

■ BLOCK DIAGRAM



■ PIN ARRANGEMENT



■ FUNCTION TABLE

Mode Control	Inputs							Outputs			
	Clocks		Serial	Parallel				Q_A	Q_B	Q_C	Q_D
	2(L)	1(H)		A	B	C	D				
H	H	X	X	X	X	X	X	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}
H	↓	X	X	a	b	c	d	a	b	c	d
H	↓	X	X	$Q_B^\dagger$	$Q_C^\dagger$	$Q_D^\dagger$	d	Q_{Bn}	Q_{Cn}	Q_{Dn}	d
L	L	H	X	X	X	X	X	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}
L	X	↓	H	X	X	X	X	H	Q_{An}	Q_{Bn}	Q_{Cn}
L	X	↓	L	X	X	X	X	L	Q_{An}	Q_{Bn}	Q_{Cn}
↑	L	L	X	X	X	X	X	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}
↓	L	L	X	X	X	X	X	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}
↓	L	H	X	X	X	X	X	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}
↑	H	L	X	X	X	X	X	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}
↑	H	H	X	X	X	X	X	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}

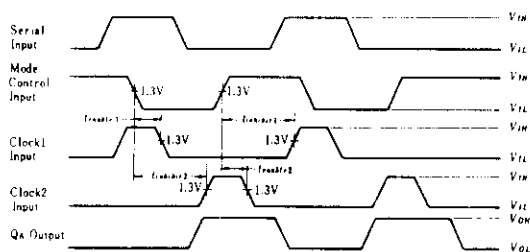
- Notes)
1. H; high level, L; low level, X; irrelevant
 2. †; transition from low to high level
 3. ‡; transition from high to low level
 4. a~d; the level of steady-state input at inputs A, B, C, or D, respectively
 5. $Q_{A0} \sim Q_{D0}$; the level of Q_A , Q_B , Q_C , or Q_D , respectively,

before the indicated steady-state input conditions were established.

6. $Q_{An} \sim Q_{Dn}$; the level of Q_A , Q_B , Q_C , or Q_D , respectively, before the most-recent (†) transition of the clock.
7. ‡; Shifting left requires external connection of Q_B to A, Q_C to B, and Q_D to C. Serial data is entered at input D.

RECOMMENDED OPERATING CONDITIONS

Item	Symbol	min	typ	max	Unit
Clock frequency	f_{clock}	0	—	25	MHz
Clock pulse width	$t_{w(CK)}$	25	—	—	ns
Setup time	t_{su}	20	—	—	ns
Hold time	t_h	10	—	—	ns
Enable time 1	$t_{enable\ 1}$	20	—	—	ns
Enable time 2	$t_{enable\ 2}$	20	—	—	ns
Inhibit time 1	$t_{inhibit\ 1}$	20	—	—	ns
Inhibit time 2	$t_{inhibit\ 2}$	20	—	—	ns



Clock Enable/Inhibit Times

ELECTRICAL CHARACTERISTICS ($T_a = -20 \sim +75^\circ\text{C}$)

Item	Symbol	Test Conditions	min	typ*	max	Unit
Input voltage	V_{IH}		2.0	—	—	V
	V_{IL}		—	—	0.8	
Output voltage	V_{OH}	$V_{CC} = 4.75\text{V}, V_{IH} = 2\text{V}, V_{IL} = 0.8\text{V}, I_{OH} = -400\mu\text{A}$	2.7	—	—	V
	V_{OL}	$V_{CC} = 4.75\text{V}, V_{IH} = 2\text{V}, I_{OL} = 4\text{mA}$	—	—	0.4	V
		$V_{IL} = 0.8\text{V}, I_{OL} = 8\text{mA}$	—	—	0.5	
Input current	I_{IH}	$V_{CC} = 5.25\text{V}, V_i = 2.7\text{V}$	—	—	20	μA
	I_{IL}	$V_{CC} = 5.25\text{V}, V_i = 0.4\text{V}$	—	—	-0.4	mA
	I_i	$V_{CC} = 5.25\text{V}, V_i = 7\text{V}$	—	—	0.1	mA
Short-circuit output current	I_{os}	$V_{CC} = 5.25\text{V}$	-20	—	-100	mA
Supply current **	I_{CC}	$V_{CC} = 5.25\text{V}$	—	13	21	mA
Input clamp voltage	V_{IK}	$V_{CC} = 4.75\text{V}, I_{IN} = -18\text{mA}$	—	—	-1.5	V

* $V_{CC} = 5\text{V}, T_a = 25^\circ\text{C}$

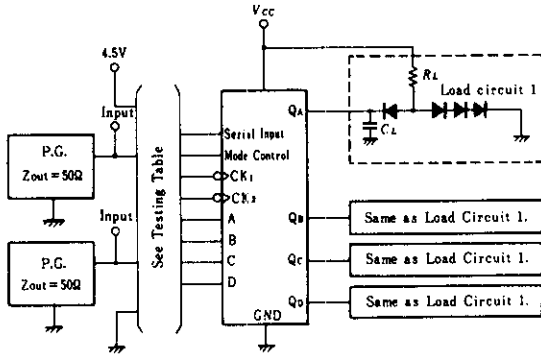
** I_{CC} is measured with all outputs and serial input open; A, B, C, and D inputs grounded; mode control at 4.5V; and momentary 3V, then ground, applied both clock inputs.

SWITCHING CHARACTERISTICS ($V_{CC} = 5\text{V}, T_a = 25^\circ\text{C}$)

Item	Symbol	Test Conditions	min	typ	max	Unit
Maximum clock frequency	f_{max}	$C_L = 15\text{pF}, R_L = 2\text{k}\Omega$	25	36	—	MHz
Propagation delay time	t_{PLH}		—	18	27	ns
	t_{PHL}		—	21	32	ns

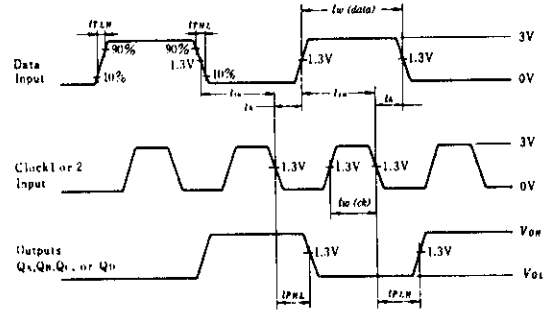
TESTING METHOD

1) Test Circuit



- Notes) 1. C_L includes probe and jig capacitance.
2. All diodes are 1S2074 P .

Waveform



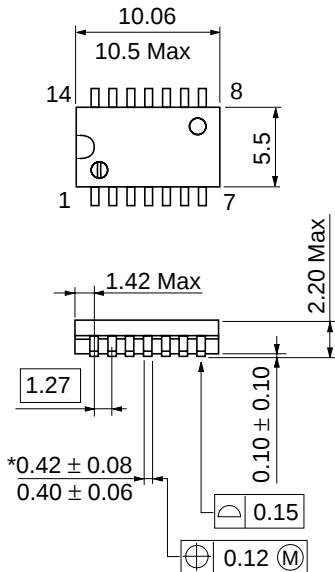
- Note) 1. Input pulse: $t_{PLH}, t_{THL} \leq 10\text{ns}$,
Data $PRR = 500\text{kHz}$
Clock $PRR = 1\text{MHz}$

2) Testing Table

Item	From input to output	Inputs								Outputs			
		CK-1	CK-2	Mode Control	Serial Inputs	A	B	C	D	QA	QB	QC	QD
f_{max}	CK-1→Q	IN	4.5V	0V	IN	4.5V	4.5V	4.5V	4.5V	OUT	OUT	OUT	OUT
	CK-2→Q	4.5V	IN	4.5V	4.5V	IN	IN	IN	IN	OUT	OUT	OUT	OUT
t_{PLH}	CK-1→Q	IN	4.5V	0V	IN	4.5V	4.5V	4.5V	4.5V	OUT	OUT	OUT	OUT
t_{PHL}	CK-2→Q	4.5V	IN	4.5V	4.5V	IN	IN	IN	IN	OUT	OUT	OUT	OUT



Hitachi Code	DP-14
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.97 g



Hitachi Code	FP-14DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.23 g

*Dimension including the plating thickness
Base material dimension



Hitachi Code	FP-14DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.13 g

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Hitachi, Ltd.

Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

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For further information write to:

Hitachi Semiconductor (America) Inc. 179 East Tasman Drive, San Jose, CA 95134 Tel: <1> (408) 433-1990 Fax: <1> (408) 433-0223	Hitachi Europe GmbH Electronic components Group Dornacher Straße 3 D-85622 Feldkirchen, Munich Germany Tel: <49> (89) 9 9180-0 Fax: <49> (89) 9 29 30 00 Hitachi Europe Ltd. Electronic Components Group. Whitebrook Park Lower Cookham Road Maidenhead Berkshire SL6 8YA, United Kingdom Tel: <44> (1628) 585000 Fax: <44> (1628) 778322
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Hitachi Asia Pte. Ltd. 16 Collyer Quay #20-00 Hitachi Tower Singapore 049318 Tel: 535-2100 Fax: 535-1533 Hitachi Asia Ltd. Taipei Branch Office 3F, Hung Kuo Building, No.167, Tun-Hwa North Road, Taipei (105) Tel: <886> (2) 2718-3666 Fax: <886> (2) 2718-8180
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Hitachi Asia (Hong Kong) Ltd. Group III (Electronic Components) 7/F., North Tower, World Finance Centre, Harbour City, Canton Road, Tsim Sha Tsui, Kowloon, Hong Kong Tel: <852> (2) 735 9218 Fax: <852> (2) 730 0281 Telex: 40815 HITEC HX
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