

HD74LS166A ●8-bit Shift Registers

The inputs are buffered to lower the drive requirements to one series 74 or 74LS standard load, respectively. Input clamping diodes minimize switching transients and simplify system design. This parallel-in or serial-in, serial-out shift register has a complexity of 77 equivalent gates on a monolithic chip. This device features gated clock inputs and an overriding clear input.

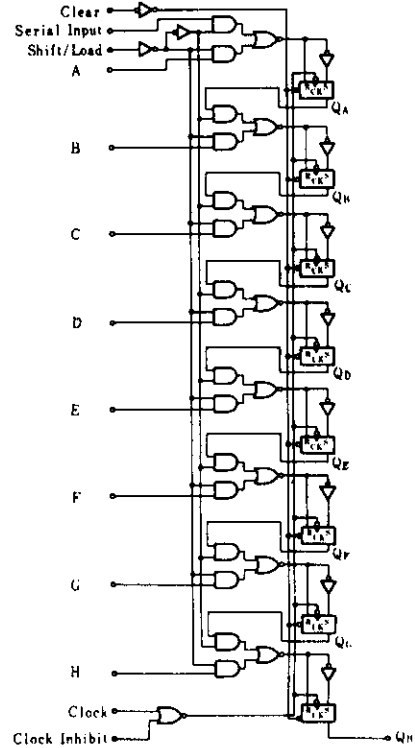
The parallel-in or serial-in modes are established by the shift/load input.

When high, this input enables the serial data input and couples the eight flip-flops for serial shifting with each clock pulse. When low, the parallel (broadside) data inputs are enabled and synchronous loading occurs on the next clock pulse. During parallel loading, serial data flow is inhibited.

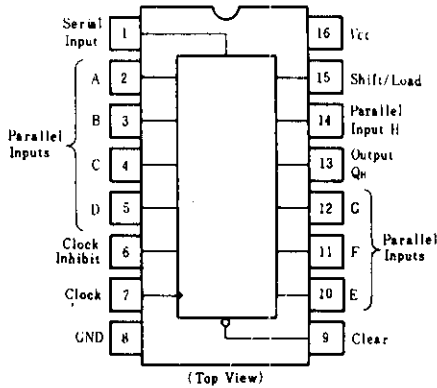
Clocking is accomplished on the low-to-high-level edge of the clock pulse through a two-input positive NOR gate permitting one input to be used as a clock-enable or clock-inhibit function. Holding either of the clock inputs high inhibits clocking; holding either low enables the other clock input.

This, of course, allows the system clock to be free-running and the register can be stopped on command with the other clock input. The clock-inhibit input should be changed to the high level only while the clock input is high. A buffered, direct clear input overrides all other inputs, including the clock, and sets all flip-flops to zero.

■ BLOCK DIAGRAM



■ PIN ARRANGEMENT



■ FUNCTION TABLE

Inputs							Internal Outputs		Outputs
Clear	Shift Load	Clock Inhibit	Clock	Serial	Parallel A...H	QA	QH	QH	
L	X	X	X	X	X	L	L	L	
H	X	L	L	X	X	QA(i)	QH(i)	QH(i)	
H	L	L	↑	X	a...h	a	b	h	
H	H	L	↑	H	X	H	QA(n)	QH(n)	
H	H	L	↑	L	X	L	QA(n)	QH(n)	
H	X	H	↑	X	X	QA(i)	QH(i)	QH(i)	

- 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~h; the level of steady-state input at inputs A to H respectively
 5. QA(i)~QH(i); the level of QA to QH, respectively, before the indicated steady-state input conditions were established.
 6. QA(n)~QH(n); the level of QA to QH, respectively, before the most recent ↓ transition of the clock.

■ RECOMMENDED OPERATING CONDITIONS

Item	Symbol	min	nom	max	Unit
High level output current	I_{OH}	—	—	-400	μA
Low level output current	I_{OL}	—	—	8	mA
Clock frequency	f_{clock}	0	—	25	MHz
Clock and clear pulse width	t_w	20	—	—	ns
Mode control setup time	t_{su}	30	—	—	ns
Data setup time	t_{su}	20	—	—	ns
Hold time	t_h	0	—	—	ns

HD74LS166A

■ 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	V
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	V
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}	$V_{CC} = 5.25\text{V}$	---	20	32	mA
Input clamp voltage	V_{IK}	$V_{CC} = 4.75\text{V}$, $I_{IK} = -18\text{mA}$	---	---	-1.5	V

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

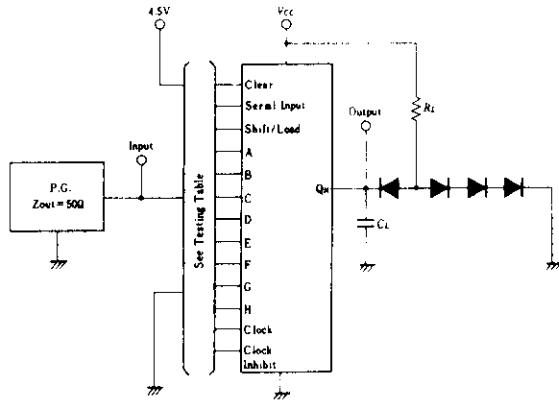
** With all outputs open, 4.5V applied to the serial input and all other inputs except the clock grounded, I_{CC} is measured after a momentary ground, then 4.5V, is applied to clock.

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

Item	Symbol	Inputs	Test Conditions	min	typ	max	Unit
Maximum clock frequency	f_{max}			25	35	---	MHz
Propagation delay time	t_{PHL}	Clear	$C_L = 15\text{pF}$	---	19	30	ns
	t_{PHL}	Clock	$R_L = 2\text{k}\Omega$	7	14	25	ns
	t_{PLH}			5	11	20	ns

■ TESTING METHOD

1) Test Circuit

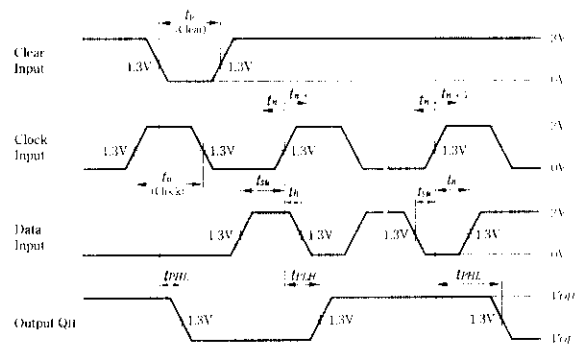


- Notes) 1. C_L includes probe and jig capacitance.
2. All diodes are 1S2074 (H).

2) Testing Table

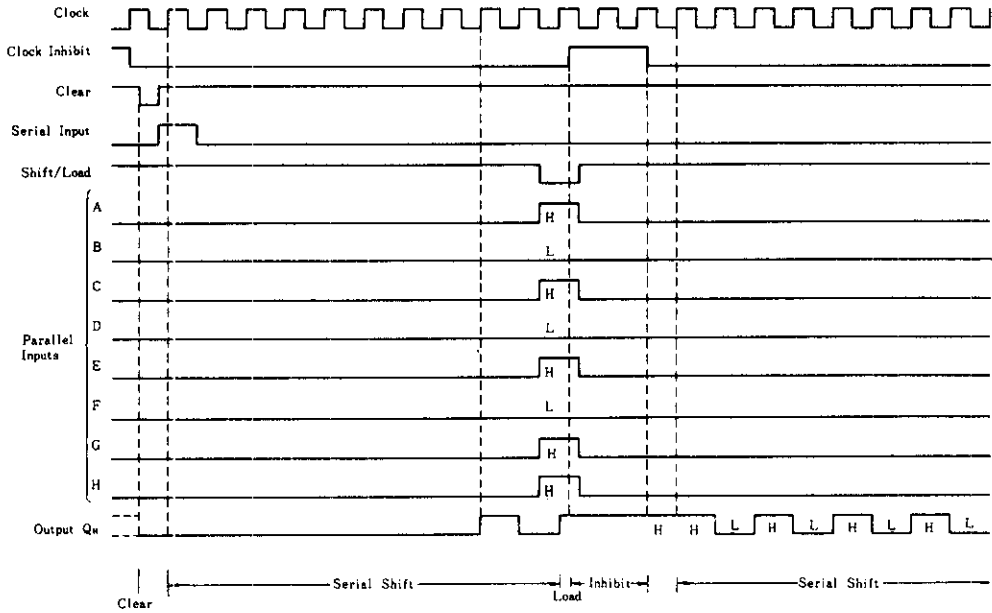
Data inputs	Shift/Load	Output	Bit time
Data H	0V	Q_H	t_{n+1}
Serial-in	4.5V	Q_H	t_{n+8}

Waveform



- Notes) 1. Input pulse: $t_{TLH} \leq 15\text{ns}$, $t_{THL} \leq 6\text{ns}$, $PRR = 1\text{MHz}$ duty cycle 50%
Clock input: $t_w \geq 20\text{ns}$
Clear input: $t_w \geq 20\text{ns}$, $t_h = 10\text{ns}$, when testing f_{max} , vary the clock PRR .
2. Propagation delay time (t_{PLH} and t_{PHL}) are measured at t_{n+1} . Proper shifting of data is verified at t_{n+8} with a functional test.
3. t_n : bit time before clocking transition.
 t_{n+1} : bit time after one clocking transition.
 t_{n+8} : bit time after eight clocking transition.

■ TYPICAL CLEAR, SHIFT, LOAD, INHIBIT, AND SHIFT SEQUENCES





Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.24 g



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-16DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.15 g

Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

HITACHI

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

URL North America : <http://semiconductor.hitachi.com/>
 Europe : <http://www.hitachi-eu.com/hel/ecg>
 Asia (Singapore) : <http://www.has.hitachi.com.sg/grp3/sicd/index.htm>
 Asia (Taiwan) : http://www.hitachi.com.tw/E/Product/SICD_Frame.htm
 Asia (HongKong) : <http://www.hitachi.com.hk/eng/bo/grp3/index.htm>
 Japan : <http://www.hitachi.co.jp/Sicd/indx.htm>

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

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

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

Copyright ' Hitachi, Ltd., 1999. All rights reserved. Printed in Japan.

HITACHI