HD14160B, HD14161B
HD14162B, HD14163B

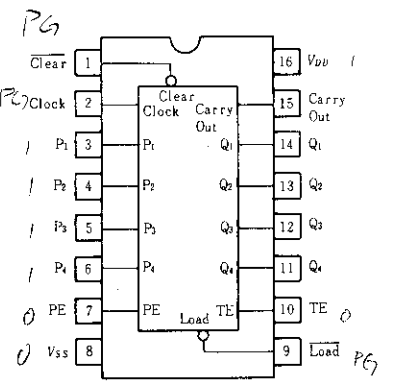
HD14160B·····Decade Counter with Asynchronous Clear
HD14161B·····4-bit Binary Counter with Asynchronous Clear
HD14162B·····Decade Counter with Synchronous Clear
HD14163B·····4-bit Binary Counter with Synchronous Clear

The HD14160B to HD14163B are synchronous programmable counters and functionally equivalent to the 74160 to 74163 TTL counters. Two are synchronous programmable decade counters with asynchronous and synchronous clear inputs respectively (HD14160B, HD14162B). The other two are synchronous programmable 4-bit binary counters with the asynchronous and synchronous clear respectively (HD14161B, HD14163B).

■ FEATURES

- Internal Look-Ahead for Fast Counting
- Carry Output for N-bit Cascading
- Synchronously Programmable
- Synchronous Counting
- Load Control Line
- Synchronous or Asynchronous Clear Positive Edge Clocked

■ PIN ARRANGEMENT

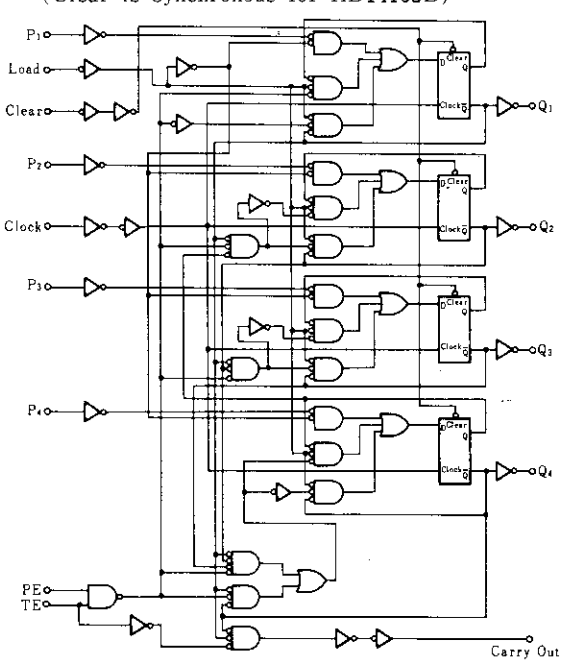


(Top View)

■ LOGIC DIAGRAM

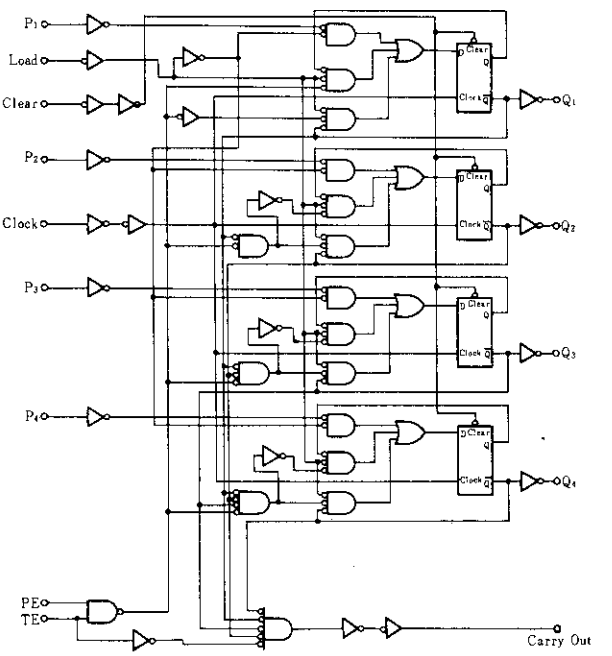
● HD14160B, HD14162B

(Clear is synchronous for HD14162B)



● HD14161B, HD14163B

(Clear is Synchronous for HD14163B)

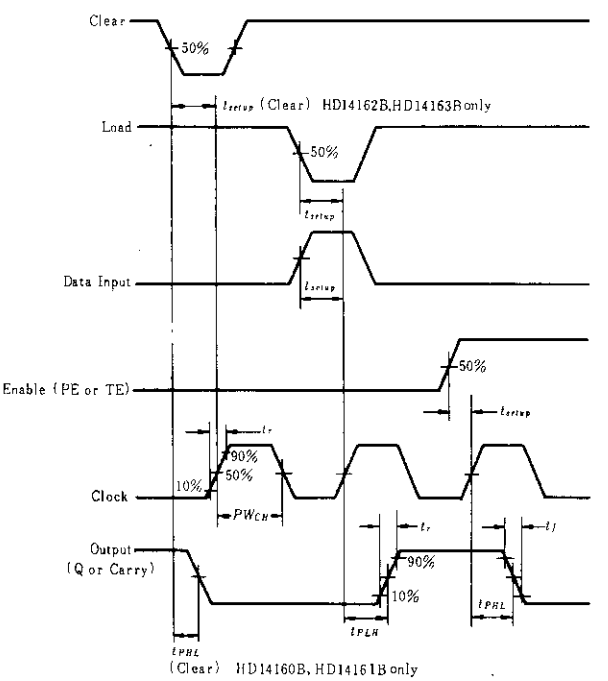


■ ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	V_{DD}(V)	Test Conditions	−40°C min	−40°C max	25°C min	25°C typ	25°C max	85°C min	85°C max	Unit
Output Voltage	V_{OL}	5.0	$V_{in}=V_{DD}$ or 0	—	0.05	—	0	0.05	—	0.05	V
		10		—	0.05	—	0	0.05	—	0.05	
		15		—	0.05	—	0	0.05	—	0.05	
	V_{OH}	5.0	$V_{in}=0$ or V_{DD}	4.95	—	4.95	5.0	—	4.95	—	V
		10		9.95	—	9.95	10	—	9.95	—	
		15		14.95	—	14.95	15	—	14.95	—	
Input Voltage	V_{IL}	5.0	$V_{out}=4.5$ or 0.5V	—	1.5	—	2.25	1.5	—	1.5	V
		10	$V_{out}=9.0$ or 1.0V	—	3.0	—	4.50	3.0	—	3.0	
		15	$V_{out}=13.5$ or 1.5V	—	4.0	—	6.75	4.0	—	4.0	
	V_{IH}	5.0	$V_{out}=0.5$ or 4.5V	3.5	—	3.5	2.75	—	3.5	—	V
		10	$V_{out}=1.0$ or 9.0V	7.0	—	7.0	5.50	—	7.0	—	
		15	$V_{out}=1.5$ or 13.5V	11.0	—	11.0	8.25	—	11.0	—	
Output Drive Current	I_{OH}	5.0	$V_{OH}=2.5$V	−2.5	—	−2.1	−4.2	—	−1.7	—	mA
		5.0	$V_{OH}=4.6$V	−0.52	—	−0.44	−0.88	—	−0.36	—	
		10	$V_{OH}=9.5$V	−1.3	—	−1.1	−2.25	—	−0.9	—	
		15	$V_{OH}=13.5$V	−3.6	—	−3.0	−8.8	—	−2.4	—	
	I_{OL}	5.0	$V_{OL}=0.4$V	0.52	—	0.44	0.88	—	0.36	—	mA
		10	$V_{OL}=0.5$V	1.3	—	1.1	2.25	—	0.9	—	
		15	$V_{OL}=1.5$V	3.6	—	3.0	8.8	—	2.4	—	
Input Current	I_{in}	15		—	±0.3	—	±0.00001	±0.3	—	±1.0	μA
Input Capacitance	C_{in}	—	$V_{in}=0$	—	—	—	5.0	7.5	—	—	pF
Quiescent Current	I_{DD}	5.0	Zero Signal, per Package	—	20	—	0.005	20	—	150	μA
		10		—	40	—	0.010	40	—	300	
		15		—	80	—	0.015	80	—	600	
Total Supply Current*	I_T	5.0	Dynamic $+I_{DD}$, per Gate, $C_L=50$pF, $f=1$kHz	—	—	—	0.56	—	—	—	μA
		10		—	—	—	1.1	—	—	—	
		15		—	—	—	1.9	—	—	—	

* To calculate total supply current at frequency other than 1kHz.
@$V_{DD}=5.0$V $I_T=(0.56\mu A/kHz)f+I_{DD}$, @$V_{DD}=10$V $I_T=(1.1\mu A/kHz)f+I_{DD}$, @$V_{DD}=15$V $I_T=(1.9\mu A/kHz)f+I_{DD}$

■ DYNAMIC SIGNAL WAVEFORMS

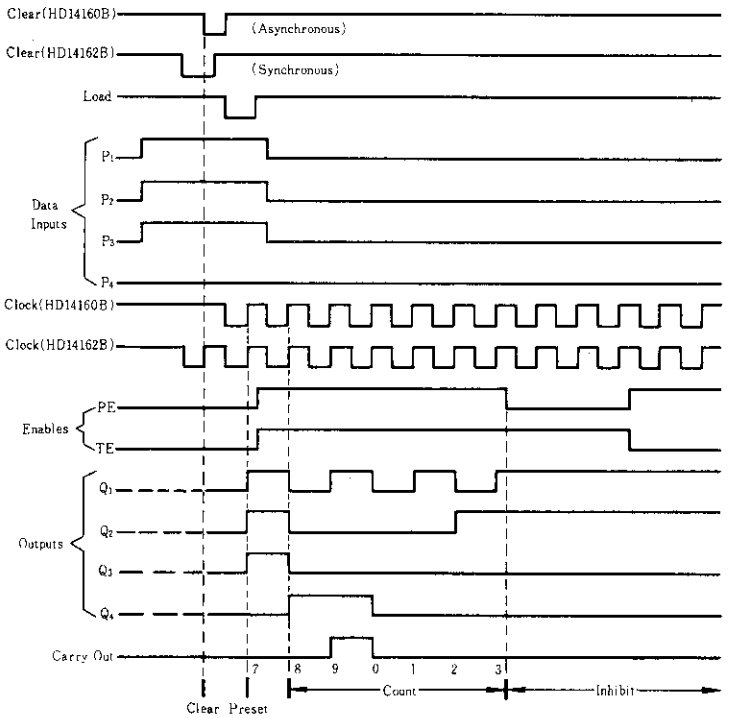


■ SWITCHING CHARACTERICS (C_L=50pF, Ta=25°C)

Characteristic		Symbol	V_{DD}(V)	min	typ	max	Unit
Output Rise Time		t_r	5.0	—	100	200	ns
			10	—	50	100	
			15	—	40	80	
Output Fall Time		t_f	5.0	—	100	200	ns
			10	—	50	100	
			15	—	40	80	
Propagation Delay Time	Clock to Q	t_{PLH}, t_{PHL}	5.0	—	350	700	ns
			10	—	150	300	
			15	—	100	200	
	Clock to Carry Out		5.0	—	440	880	
			10	—	185	370	
			15	—	125	250	
	TE to Carry Out		5.0	—	300	600	
			10	—	130	260	
			15	—	90	180	
	Clear to Q (HD14160B, HD14161B only)		5.0	—	155	310	
			10	—	55	110	
			15	—	35	70	
Setup Time	Data to Clock	t_{setup}	5.0	320	160	—	ns
			10	130	65	—	
			15	90	45	—	
	Load to Clock		5.0	600	300	—	
			10	260	130	—	
			15	180	90	—	
	Enable to Clock (PE or TE)		5.0	420	210	—	
			10	170	85	—	
			15	120	60	—	
	Clear to Clock (HD14162B, HD14163B only)		5.0	310	155	—	
			10	110	55	—	
			15	70	35	—	
Clock Pulse Width		PW_{CH}	5.0	250	125	—	ns
			10	100	50	—	
			15	70	35	—	
Clock Rise Time		t_r	5.0	—	—	15	μs
			10	—	—	15	
			15	—	—	15	
Clock Frequency		PRF	5.0	—	2.0	1.0	MHz
			10	—	5.0	2.5	
			15	—	8.0	4.0	

■ TIMING DIAGRAM

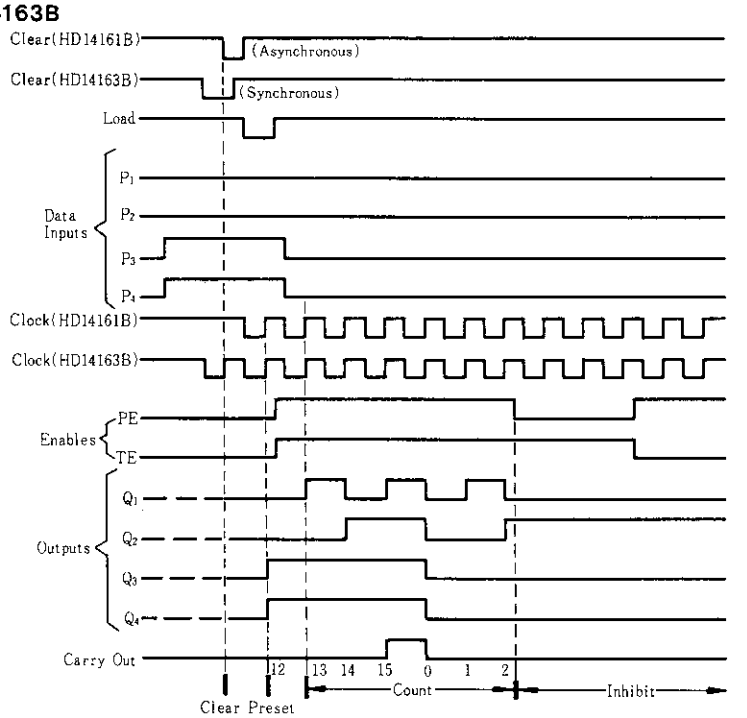
● HD14160B, HD14162B



Sequence illustrated in waveforms:

1. Clear outputs to zero.
2. Preset to BCD seven.
3. Count to eight, nine, zero, one, two, and three.
4. Inhibit

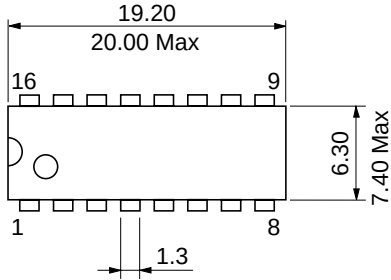
● HD14161B, HD14163B

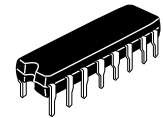


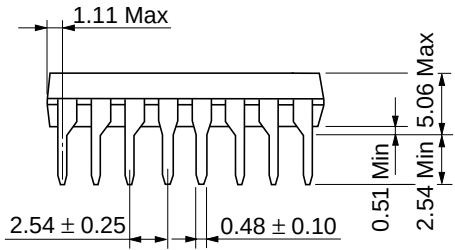
Sequence illustrated in waveforms:

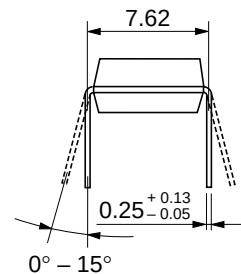
1. Clear outputs to zero.
2. Preset to binary twelve.
3. Count to thirteen, fourteen, fifteen, zero, one, and two.
4. Inhibit

Unit: mm









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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

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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

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