

HD14518B, HD14520B

Dual BCD Up CounterHD14518B

Dual Binary Up CounterHD14520B

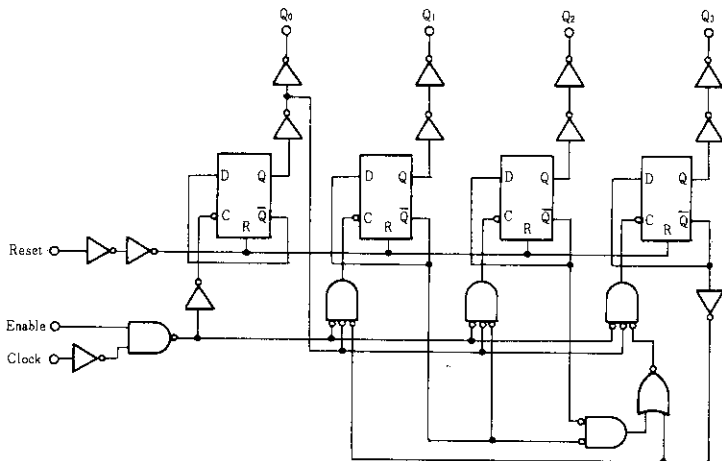
The HD14518B dual BCD counter and the HD14520B dual binary counter consist of two identical, independent, internally synchronous 4-stage counters. The counter stages are type D flip-flops, with interchangeable Clock and Enable lines for incrementing on either the positive-going or negative-going transition as required when cascading multiple stages. Each counter can be cleared by applying a high level on the Reset line. In addition, the HD14518B will count out of all undefined states within two clock periods. These complementary MOS up counters find primary use in multi-stage synchronous or ripple counting applications requiring low power dissipation and/or high noise immunity.

FEATURES

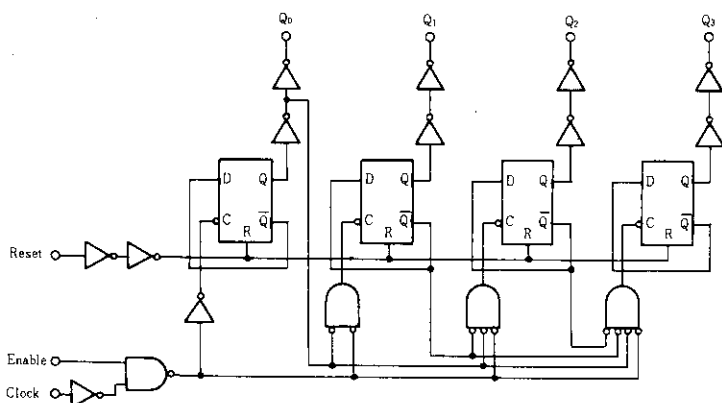
- Quiescent Current = 5nA/pkg typ. @5V
- Supply Voltage Range = 3 to 18V
- Internally Synchronous for High Internal and External Speeds
- Logic Edge-clocked Design ... Incremented on Positive Transition of Clock or Negative Transition of Enable
- 6MHz Counting Rate
- Capable of Driving One Low-power Schottky TTL Load Over the Rated Temperature Range

LOGIC DIAGRAM

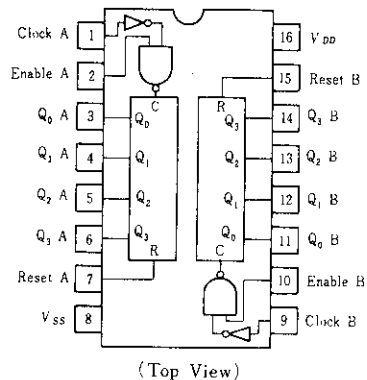
HD14518B (1/2)



HD14520B (1/2)



PIN ARRANGEMENT



TRUTH TABLE

Clock	Enable	Reset	Action
	1	0	Increment Counter
0		0	Increment Counter
	x	0	No Change
x		0	No Change
	0	0	No Change
1		0	No Change
x	x	1	$Q_0 \sim Q_3 = 0$

x = Don't Care

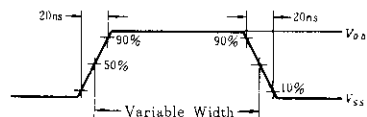
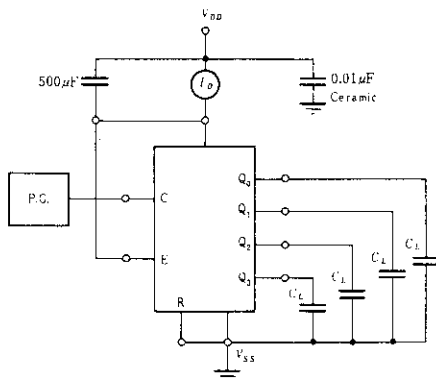
■ ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	V _{DD} (V)	Test Conditions	-40°C		25°C			85°C		Unit
				min	max	min	typ	max	min	max	
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} = 13.5V 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} = 2.5V	-1.0	—	-0.8	-1.7	—	-0.6	—	mA
		5.0	V _{OH} = 4.6V	-0.2	—	-0.16	-0.36	—	-0.12	—	
		10	V _{OH} = 9.5V	-0.5	—	-0.4	-0.9	—	-0.3	—	
		15	V _{OH} = 13.5V	-1.4	—	-1.2	-3.5	—	-1.0	—	
	I _{OL}	5.0	V _{OL} = 0.4V	0.52	—	0.44	0.88	—	0.36	—	mA
		10	V _{OL} = 0.5V	1.3	—	1.1	2.25	—	0.9	—	
15		V _{OL} = 1.5V	3.6	—	3.0	8.8	—	2.4	—		
Input Current	I _{in}	15		—	±0.3	—	±0.0001	±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} ,	—	—	—	0.6	—	—	—	μA
		10	per Gate	—	—	—	1.2	—	—	—	
		15	C _L = 50pF, f = 1 kHz	—	—	—	1.7	—	—	—	

* To calculate total supply current at frequency other than 1kHz.

@ V_{DD} = 5.0V I_T = (0.6 μA/kHz) f + I_{DD}. @ V_{DD} = 10V I_T = (1.2 μA/kHz) f + I_{DD}. @ V_{DD} = 15V I_T = (1.7 μA/kHz) f + I_{DD}

■ POWER DISSIPATION TEST CIRCUIT AND WAVEFORM

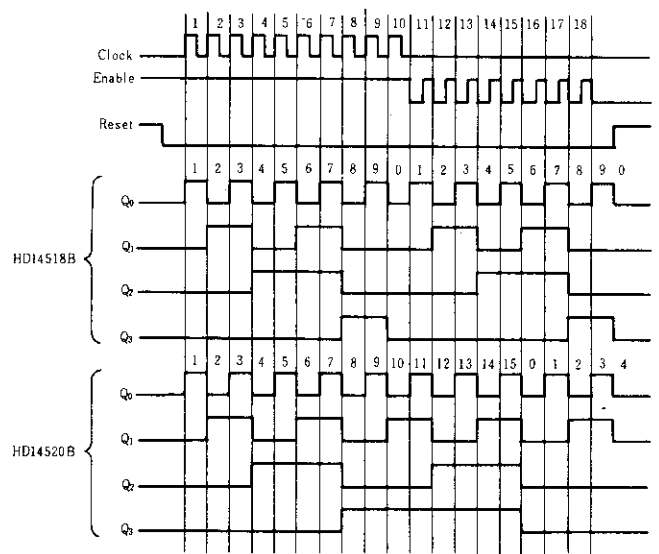
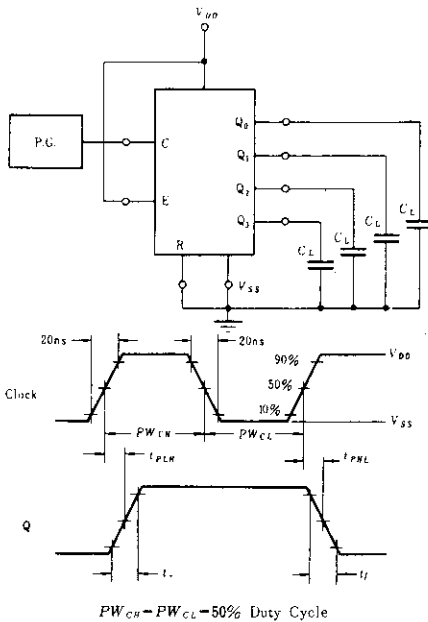


■ SWITCHING CHARACTERISTICS ($C_L=50\text{pF}$, $T_a=25^\circ\text{C}$)

Characteristic		Symbol	$V_{DD}(\text{V})$	min	typ	max	Unit
Output Rise Time		t_r	5.0	—	180	360	ns
			10	—	90	180	
			15	—	65	130	
Output Fall Time		t_f	5.0	—	130	250	ns
			10	—	50	100	
			15	—	40	80	
Propagation Delay Time	Clock	t_{PLH}	5.0	—	280	560	ns
			10	—	115	230	
			15	—	80	160	
	Reset	t_{PHL}	5.0	—	440	800	
			10	—	160	300	
			15	—	110	220	
Clock Pulse Width		PW_{CH} PW_{CL}	5.0	200	100	—	ns
			10	100	50	—	
			15	70	35	—	
Clock Frequency		PRF	5.0	—	5.0	2.5	MHz
			10	—	10.0	5.0	
			15	—	15.0	7.5	
Clock Pulse or Enable Rise and Fall Time		t_r, t_f	5.0	—	—	15	μs
			10	—	—	15	
			15	—	—	15	
Enable Pulse Width		PW_E	5.0	440	220	—	ns
			10	200	100	—	
			15	140	70	—	
Reset Pulse Width		PW_R	5.0	250	125	—	ns
			10	110	55	—	
			15	80	40	—	

■ SWITCHING TIME TEST CIRCUIT

■ TIMING DIAGRAM





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