

# HD14518B, HD14520B

Dual BCD Up Counter ..... HD14518B

Dual Binary Up Counter ..... HD14520B

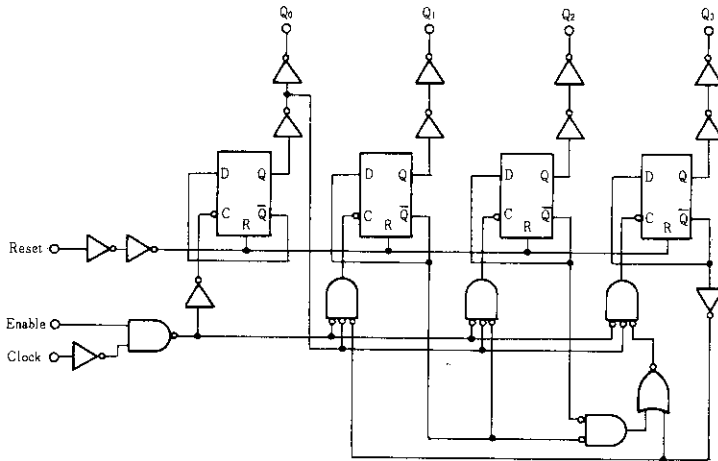
The HD14518B dual BCD counter and the HD14520B dual binary counter consist of two identical, independent, internally synchronous 4-stage counters. The counter stages are type D flip-flops, with interchangeable Clock and Enable lines for incrementing on either the positive-going or negative-going transition 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

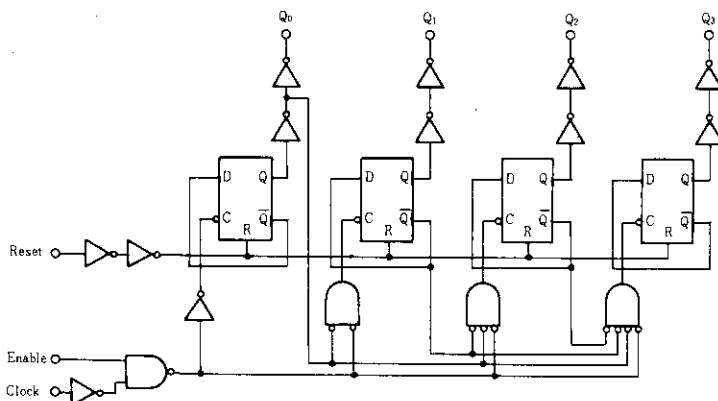
- Quiescent Current = 5nA/pkg typ. @5V
- Supply Voltage Range = 3 to 18V
- Internally Synchronous for High Internal and External Speeds
- Logic Edge-clocked Design ... Incremented on Positive Transition of Clock or Negative Transition of Enable
- 6MHz Counting Rate
- Capable of Driving One Low-power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

## LOGIC DIAGRAM

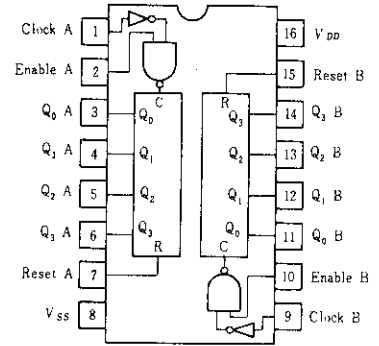
### HD14518B (1/2)



### HD14520B (1/2)



## PIN ARRANGEMENT



(Top View)

## 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

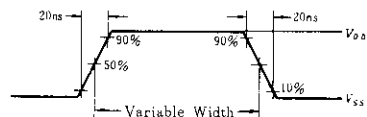
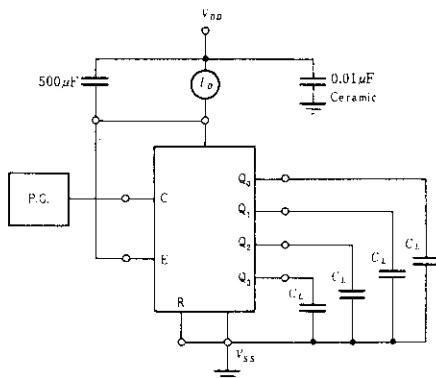
■ ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	V <sub>DD</sub> (V)	Test Conditions	-40°C		25°C			85°C		Unit
				min	max	min	typ	max	min	max	
Output Voltage	V <sub>OL</sub>	5.0	V <sub>in</sub> = V <sub>DD</sub> 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 <sub>OH</sub>	5.0	V <sub>in</sub> = 0 or V <sub>DD</sub>	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 <sub>IL</sub>	5.0	V <sub>out</sub> = 4.5 or 0.5V	—	1.5	—	2.25	1.5	—	1.5	V
		10	V <sub>out</sub> = 9.0 or 1.0V	—	3.0	—	4.50	3.0	—	3.0	
		15	V <sub>out</sub> = 13.5V or 1.5V	—	4.0	—	6.75	4.0	—	4.0	
	V <sub>IH</sub>	5.0	V <sub>out</sub> = 0.5 or 4.5V	3.5	—	3.5	2.75	—	3.5	—	V
		10	V <sub>out</sub> = 1.0 or 9.0V	7.0	—	7.0	5.50	—	7.0	—	
		15	V <sub>out</sub> = 1.5 or 13.5V	11.0	—	11.0	8.25	—	11.0	—	
Output Drive Current	I <sub>OH</sub>	5.0	V <sub>OH</sub> = 2.5V	-1.0	—	-0.8	-1.7	—	-0.6	—	mA
		5.0	V <sub>OH</sub> = 4.6V	-0.2	—	-0.16	-0.36	—	-0.12	—	
		10	V <sub>OH</sub> = 9.5V	-0.5	—	-0.4	-0.9	—	-0.3	—	
		15	V <sub>OH</sub> = 13.5V	-1.4	—	-1.2	-3.5	—	-1.0	—	
	I <sub>OL</sub>	5.0	V <sub>OL</sub> = 0.4V	0.52	—	0.44	0.88	—	0.36	—	mA
		10	V <sub>OL</sub> = 0.5V	1.3	—	1.1	2.25	—	0.9	—	
15		V <sub>OL</sub> = 1.5V	3.6	—	3.0	8.8	—	2.4	—		
Input Current	I <sub>in</sub>	15		—	±0.3	—	±0.0001	±0.3	—	±1.0	μA
Input Capacitance	C <sub>in</sub>		V <sub>in</sub> = 0	—	—	—	5.0	7.5	—	—	pF
Quiescent Current	I <sub>DD</sub>	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 <sub>T</sub>	5.0	Dynamic + I <sub>DD</sub> ,	—	—	—	0.6	—	—	—	μA
		10	per Gate	—	—	—	1.2	—	—	—	
		15	C <sub>L</sub> = 50pF, f = 1 kHz	—	—	—	1.7	—	—	—	

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

@ V<sub>DD</sub> = 5.0V I<sub>T</sub> = (0.6 μA/kHz) f + I<sub>DD</sub>. @ V<sub>DD</sub> = 10V I<sub>T</sub> = (1.2 μA/kHz) f + I<sub>DD</sub>. @ V<sub>DD</sub> = 15V I<sub>T</sub> = (1.7 μA/kHz) f + I<sub>DD</sub>

■ POWER DISSIPATION TEST CIRCUIT AND WAVEFORM

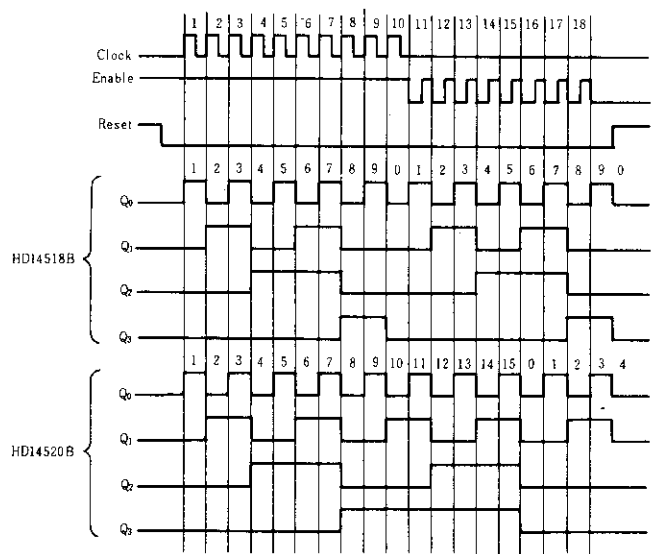
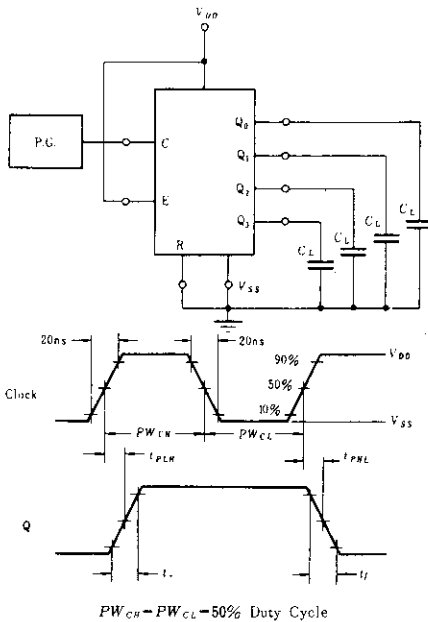


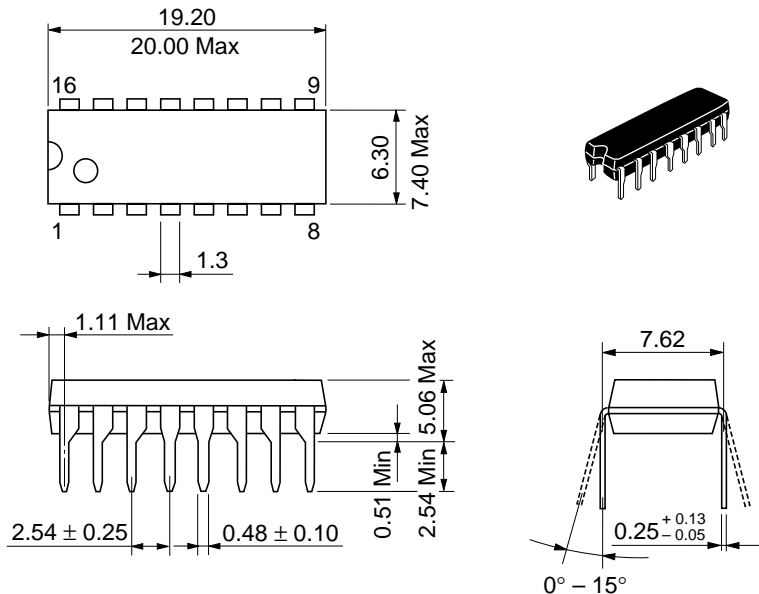
■ SWITCHING CHARACTERISTICS ( $C_L=50\text{pF}$ ,  $T_a=25^\circ\text{C}$ )

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	$\mu\text{s}$
			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

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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

URL      North America      : <http://semiconductor.hitachi.com/>  
             Europe                : <http://www.hitachi-eu.com/hel/ecg>  
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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

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