

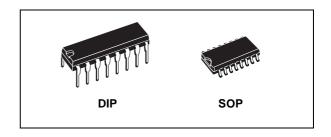


## **DUAL BINARY UP COUNTER**

- MEDIUM SPEED OPERATION : 6MHz (Typ.) at 10V
- POSITIVE -OR NEGATIVE- EDGE TRIGGERING
- SYNCHRONOUS INTERNAL CARRY PROPAGATION
- QUIESCENT CURRENT SPECIF. UP TO 20V
- 5V, 10V AND 15V PARAMETRIC RATINGS
- INPUT LEAKAGE CURRENT I<sub>I</sub> = 100nA (MAX) AT V<sub>DD</sub> = 18V T<sub>A</sub> = 25°C
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"



HCF4520B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages. HCF4520B, a Dual Binary Up Counter, consists of two identical, internal 4-stage counters. The counter stages are D-type Flip-Flops having interchangeable Clock and Enable lines for

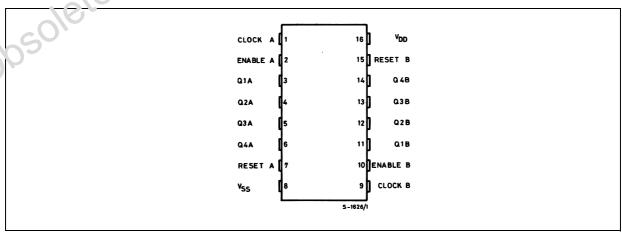


#### **ORDER CODES**

PACKAGE	TUBE	1 & R
DIP	HCF4520BEY	.10
SOP	HCF4520BM1	HCF4520M013TR

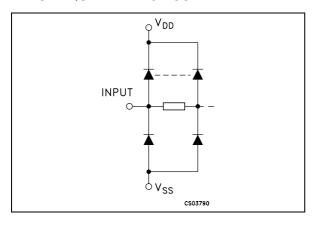
incrementing on either the positive-going or negative going transitions. For single-unit operations the Enable input is maintained High and the courter advances on each positive going transition of the Clock. The counters are cleared by high levels on their Reset lines. The counter can be cascaded in the ripple mode by connecting Q4 to the enable input of the subsequent counter while the clock input of the latter is held low.

# PIN CONNECTION



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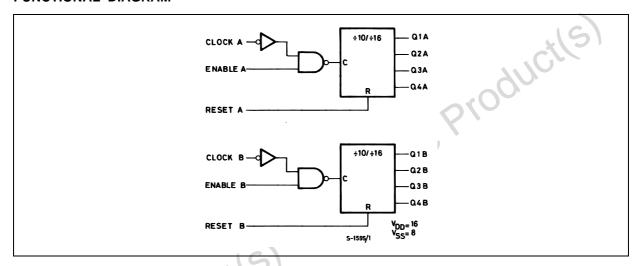
#### **IINPUT EQUIVALENT CIRCUIT**



#### **PIN DESCRIPTION**

PIN No	SYMBOL	NAME AND FUNCTION
1	CLOCK A	Clock A input
2	ENABLE A	Enable A Input
7	RESET A	Reset A Input
3, 4, 5, 6	Q1A to Q4A	Data Outputs
9	CLOCK B	Clock B input
10	ENABLE B	Enable B Input
15	RESET B	Reset B Input
11,12,13,14	Q1B to Q4B	Data Outputs
8	$V_{SS}$	Negative Supply Voltage
16	$V_{DD}$	Positive Supply Voltage

#### **FUNCTIONAL DIAGRAM**

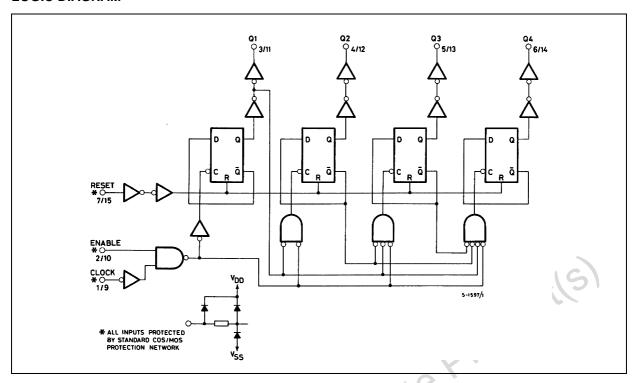


#### **TRUTH TABLE**

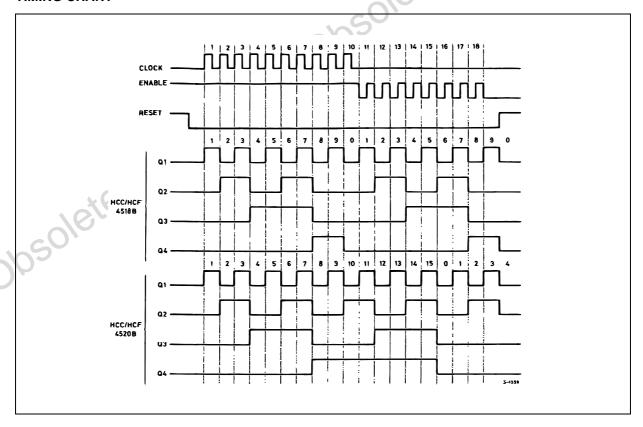
CLOCK	ENABLE	RESET	ACTION
7 0	Н	L	INCREMENT COUNTER
L	T_	L	INCREMENT COUNTER
7/6	X	L	NO CHANGE
X		L	NO CHANGE
~5°	L	L	NO CHANGE
Н	7	L	NO CHANGE
Х	X	Н	Q1 THRU Q4 = 0

X : Don't Care

#### **LOGIC DIAGRAM**



#### **TIMING CHART**



#### **ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>DD</sub>	Supply Voltage	-0.5 to +22	V
V <sub>I</sub>	DC Input Voltage	-0.5 to V <sub>DD</sub> + 0.5	V
I <sub>I</sub>	DC Input Current	± 10	mA
P <sub>D</sub>	Power Dissipation per Package	200	mW
	Power Dissipation per Output Transistor	100	mW
T <sub>op</sub>	Operating Temperature	-55 to +125	°C
T <sub>stg</sub>	Storage Temperature	-65 to +150	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

All voltage values are referred to V<sub>SS</sub> pin voltage.

#### **RECOMMENDED OPERATING CONDITIONS**

Parameter	Value	Unit
Supply Voltage	3 to 20	V
Input Voltage	0 to V <sub>DD</sub>	٧
Operating Temperature	-55 to 125	°C
obsoleti ste Product(s)	s Produ	
	Supply Voltage	Supply Voltage 3 to 20 Input Voltage 0 to V <sub>DD</sub>

#### **DC SPECIFICATIONS**

			Test Con	dition					Value				
Symbol Parameter		Vı	V <sub>O</sub>	v <sub>o</sub>  I <sub>o</sub>	V <sub>DD</sub>	T <sub>A</sub> = 25°C		С	-40 to 85°C		-55 to 125°C		Unit
		(V)	(V)	<b>(μΑ)</b>	(V)	Min.	Тур.	Max.	Min.	Max.	Min.	Max.	
ΙL	Quiescent Current	0/5			5		0.04	5		150		150	
		0/10			10		0.04	10		300		300	μA
		0/15			15		0.04	20		600		600	μΑ
		0/20			20		0.08	100		3000		3000	
V <sub>OH</sub>	High Level Output	0/5		<1	5	4.95			4.95		4.95		
	Voltage	0/10		<1	10	9.95			9.95		9.95		V
		0/15		<1	15	14.95			14.95		14.95		
$V_{OL}$	Low Level Output	5/0		<1	5		0.05			0.05		0.05	
	Voltage	10/0		<1	10		0.05			0.05		0.05	V
		15/0		<1	15		0.05			0.05		0.05	
$V_{IH}$	High Level Input		0.5/4.5	<1	5	3.5			3.5		3.5		
	Voltage		1/9	<1	10	7			7		7	15	V
			1.5/13.5	<1	15	11			11		11		,
$V_{IL}$	Low Level Input		4.5/0.5	<1	5			1.5		1.5		1.5	
	Voltage		9/1	<1	10			3		3		3	V
			13.5/1.5	<1	15			4	25	4		4	
I <sub>OH</sub>	Output Drive	0/5	2.5	<1	5	-1.36	-3.2		-1.1		-1.1		
	Current	0/5	4.6	<1	5	-0.44	-1	0	-0.36		-0.36		mA
		0/10	9.5	<1	10	-1.1	-2.6		-0.9		-0.9		ША
		0/15	13.5	<1	15	-3.0	-6.8		-2.4		-2.4		
l <sub>OL</sub>	Output Sink	0/5	0.4	<1	5	0.44			0.36		0.36		
	Current	0/10	0.5	<1	10	1.1	2.6		0.9		0.9		mΑ
		0/15	1.5	<1	15	3.0	6.8		2.4		2.4		
lį	Input Leakage Current	0/18	Any In	put	18		±10 <sup>-5</sup>	±0.1		±1		±1	μΑ
C <sub>I</sub>	Input Capacitance		Any In	put			5	7.5					pF

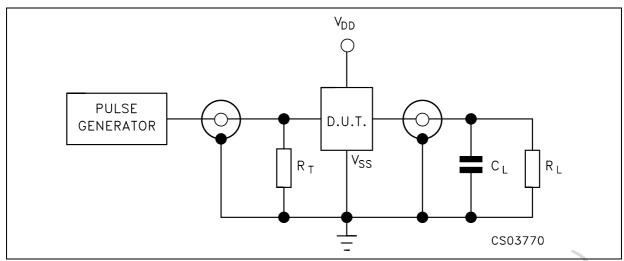
The Noise Margin for both "1" and "0" level is: 1V min. with V<sub>DD</sub>=5V, 2V min. with V<sub>DD</sub>=10V, 2.5V min. with V<sub>DD</sub>=15V

# $\textbf{DYNAMIC ELECTRICAL CHARACTERISTICS} \ (T_{amb} = 25^{\circ}C, \ C_{L} = 50 pF, \ R_{L} = 200 K\Omega, \ t_{f} = t_{f} = 20 \ ns)$

			Test Condition	١	/alue (*	·)	Unit
Symbol	Parameter	V <sub>DD</sub> (V)		Min.	Тур.	Max.	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time	5			280	560	
	Clock or Enable to Output	10			115	230	ns
		15			80	160	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Time	5			330	650	
	Reset to Output	10			130	225	ns
		15			90	170	
t <sub>TLH</sub> t <sub>THL</sub>	Transition Time	5			100	200	
		10			50	100	ns
		15			40	80	
t <sub>W</sub>	Clock Pulse Width	5		200	100		
		10		100	50		ns
		15		70	35		
t <sub>W</sub>	Reset Pulse Width	5		250	125	10	
		10		110	55		ns
		15		80	40		
t <sub>W</sub>	Enable Pulse Width	5		400	200		
		10		200	100		ns
		15		140	70		
t <sub>r</sub> , t <sub>f</sub>	Clock or Enable Rise and	5				15	
• •	Fall Time	10	leje.			15	μs
		15	78,			5	
f <sub>MAX</sub>	Maximum Clock	5	c0'	1.5	3		
	Frequency	10	-105	3	6		MHz
		15	OA	4	8		
t <sub>r</sub> , t <sub>f</sub>	Clock or Enable Rise and	5				15	
	Fall Time	10				5	μS
		15				5	

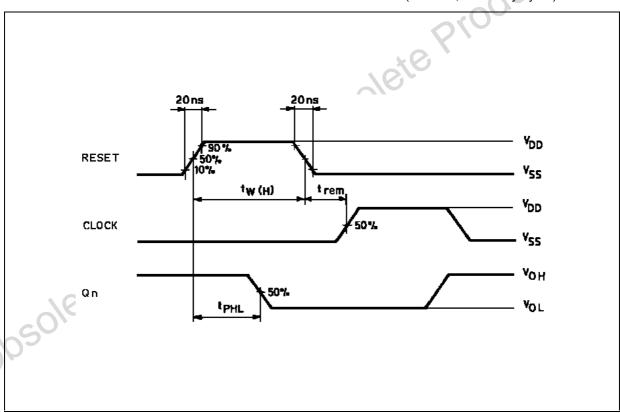
<sup>(\*)</sup> Typical temperature coefficient for all V<sub>DD</sub> value is 0.3 %/°C.

#### **TEST CIRCUIT**

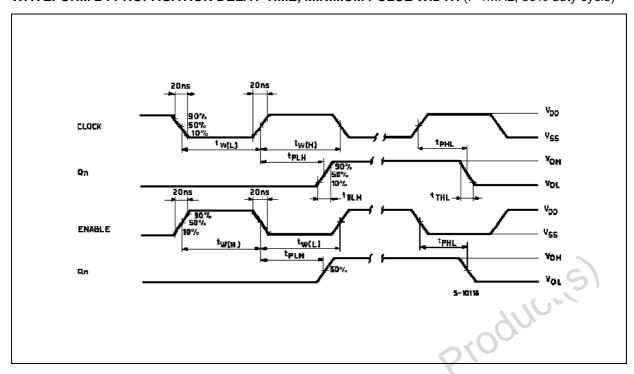


 $C_L$  = 50pF or equivalent (includes jig and probe capacitance)  $R_L$  = 200 $K\Omega$   $R_T$  =  $Z_{OUT}$  of pulse generator (typically 50 $\Omega$ )

#### WAVEFORM 1: MINIMUM PULSE WIDTH AND REMOVAL TIME (f=1MHz; 50% duty cycle)

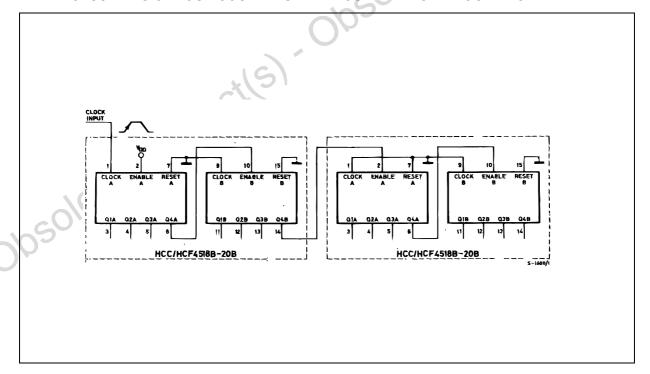


WAVEFORM 2: PROPAGATION DELAY TIME, MINIMUM PULSE WIDTH (f=1MHz; 50% duty cycle)



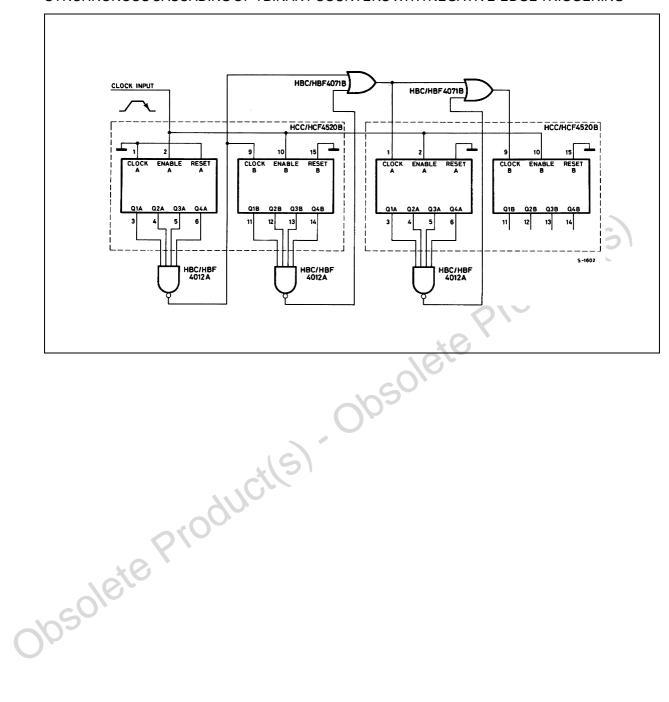
#### **TYPICAL APPLICATION**

#### RIPPLE CASCADING OF FOUR COUNTERS WITH POSITIVE-EDGE TRIGGERING



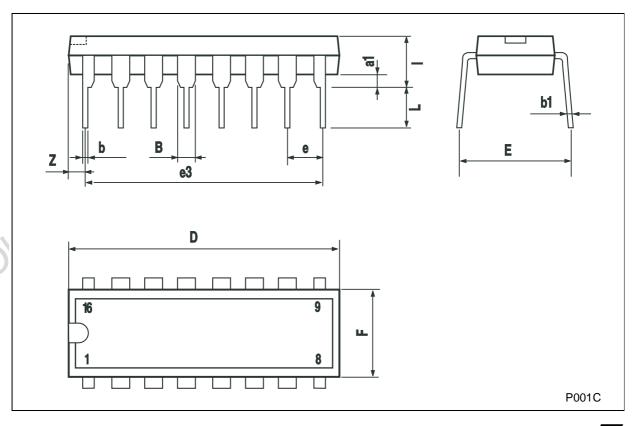
#### **TYPICAL APPLICATION**

#### SYNCHRONOUS CASCADING OF 4 BINARY COUNTERS WITH NEGATIVE-EDGE TRIGGERING



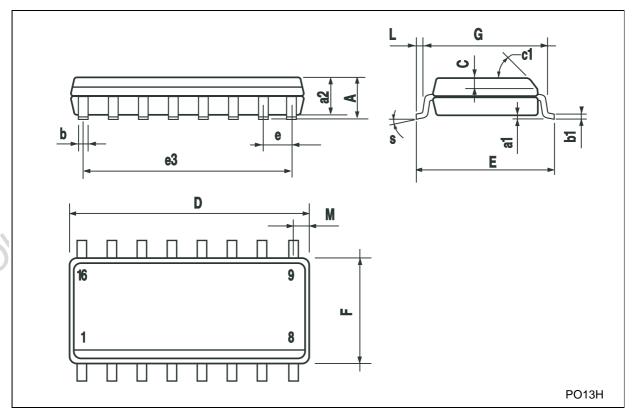
## Plastic DIP-16 (0.25) MECHANICAL DATA

DIM		mm.			inch			
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.		
a1	0.51			0.020				
В	0.77		1.65	0.030		0.065		
b		0.5			0.020			
b1		0.25			0.010			
D			20			0.787		
E		8.5			0.335			
е		2.54			0.100			
e3		17.78			0.700			
F			7.1			0.280		
I			5.1			0.201		
L		3.3			0.130			
Z			1.27			0.050		



### **SO-16 MECHANICAL DATA**

DIM		mm.		inch				
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.		
А			1.75			0.068		
a1	0.1		0.2	0.003		0.007		
a2			1.65			0.064		
b	0.35		0.46	0.013		0.018		
b1	0.19		0.25	0.007		0.010		
С		0.5			0.019			
c1			45°	(typ.)				
D	9.8		10	0.385		0.393		
E	5.8		6.2	0.228		0.244		
е		1.27			0.050			
e3		8.89			0.350			
F	3.8		4.0	0.149		0.157		
G	4.6		5.3	0.181		0.208		
L	0.5		1.27	0.019		0.050		
M			0.62			0.024		
S			8° (I	max.)		•		



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