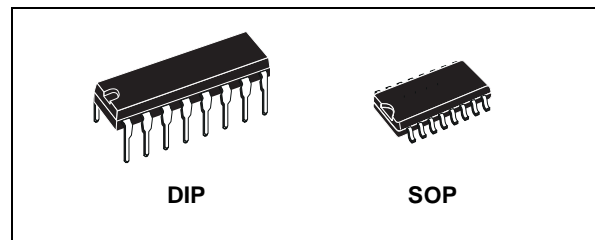




# HCF4520B

## 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  
 $I_l = 100\text{nA (MAX) AT } V_{DD} = 18\text{V } T_A = 25^\circ\text{C}$
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC JESD13B "STANDARD SPECIFICATIONS FOR DESCRIPTION OF B SERIES CMOS DEVICES"



### ORDER CODES

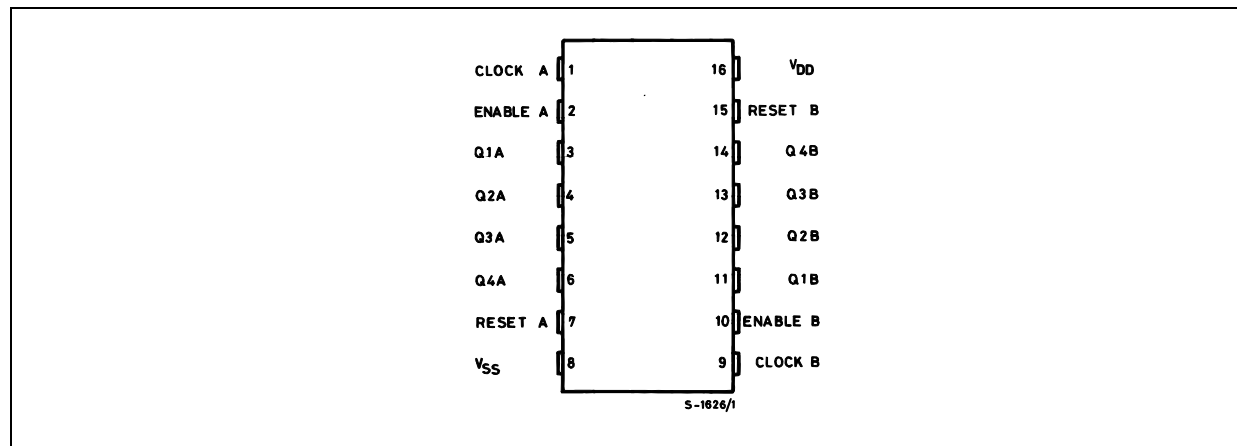
PACKAGE	TUBE	T & R
DIP	HCF4520BEY	
SOP	HCF4520BM1	HCF4520M013TR

### DESCRIPTION

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

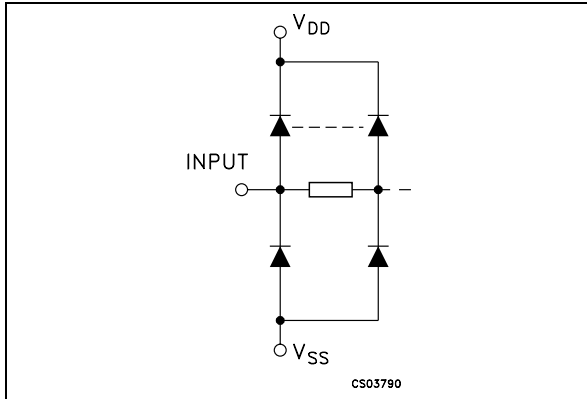
incrementing on either the positive-going or negative going transitions. For single-unit operations the Enable input is maintained High and the counter advances on each positive going transition of the Clock. The counters are cleared by high levels on their Reset lines. The counter can be cascaded in 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



# HCF4520B

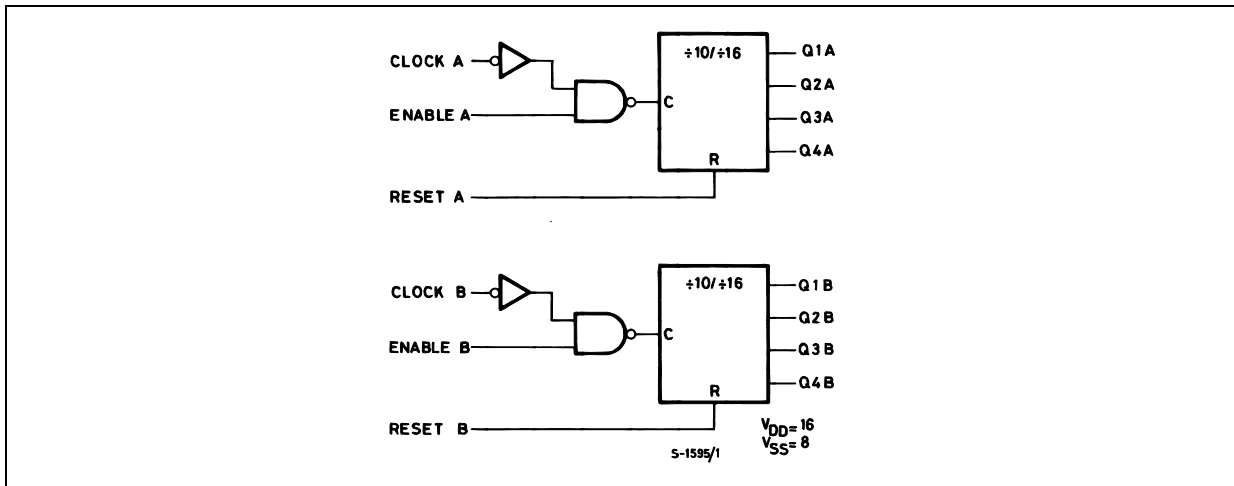
## IINPUT EQUIVALENT CIRCUIT



## 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 <sub>SS</sub>	Negative Supply Voltage
16	V <sub>DD</sub>	Positive Supply Voltage

## FUNCTIONAL DIAGRAM

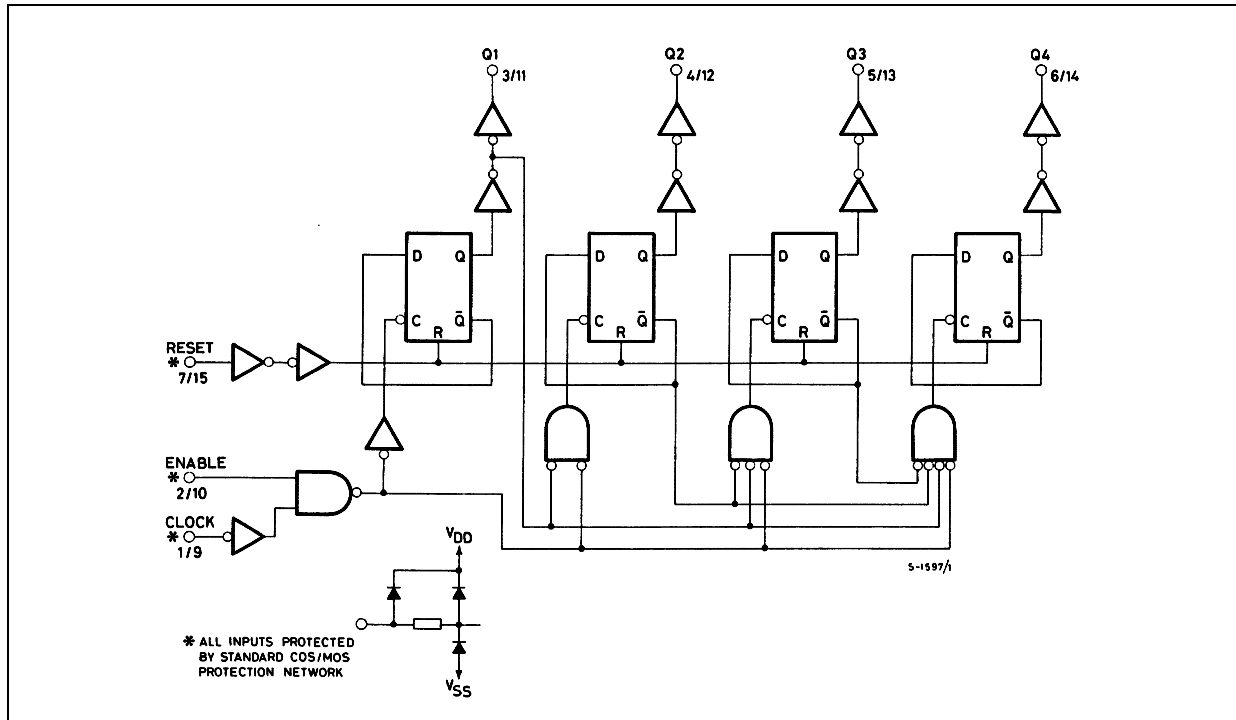


## TRUTH TABLE

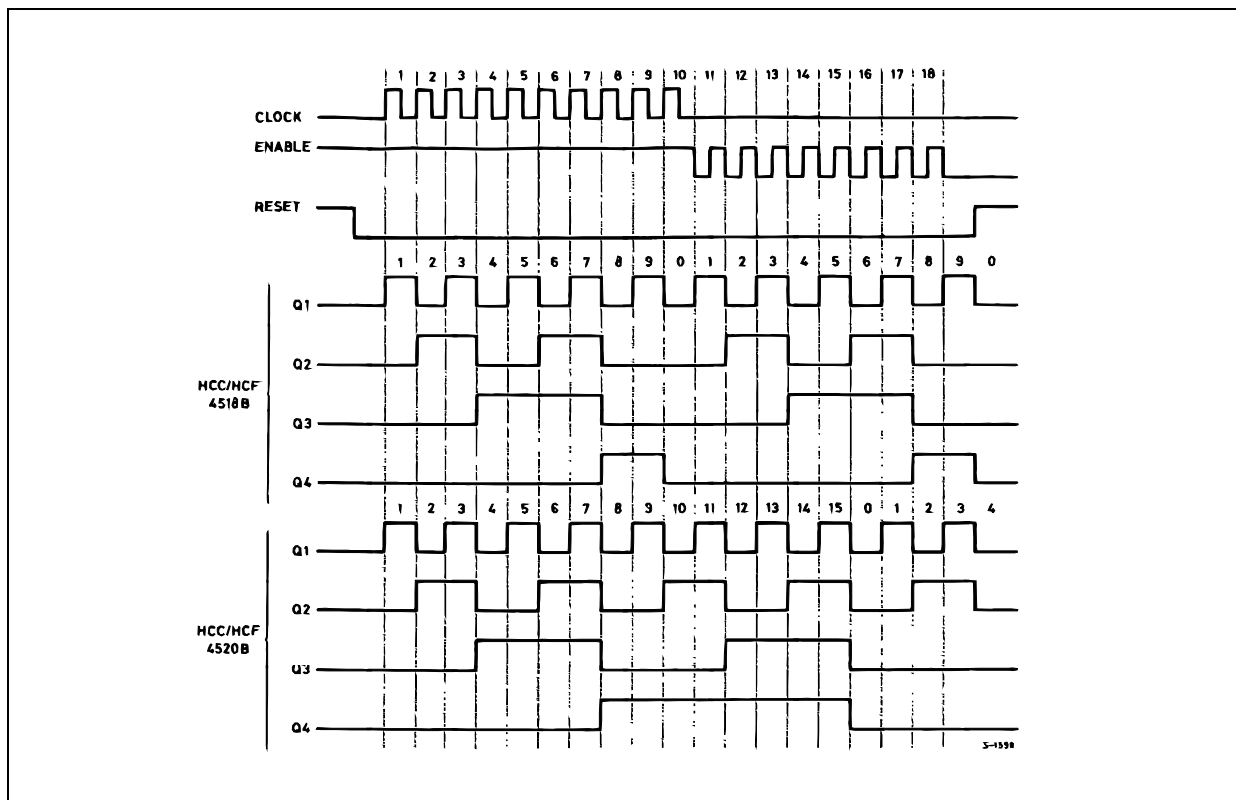
CLOCK	ENABLE	RESET	ACTION
┌	H	L	INCREMENT COUNTER
L	┐	L	INCREMENT COUNTER
┐	X	L	NO CHANGE
X	┌	L	NO CHANGE
┌	L	L	NO CHANGE
H	┐	L	NO CHANGE
X	X	H	Q1 THRU Q4 = 0

X : Don't Care

LOGIC DIAGRAM



TIMING CHART



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{DD}$	Supply Voltage	-0.5 to +22	V
$V_I$	DC Input Voltage	-0.5 to $V_{DD} + 0.5$	V
$I_I$	DC Input Current	$\pm 10$	mA
$P_D$	Power Dissipation per Package	200	mW
	Power Dissipation per Output Transistor	100	mW
$T_{op}$	Operating Temperature	-55 to +125	°C
$T_{stg}$	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  $V_{SS}$  pin voltage.

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Value	Unit
$V_{DD}$	Supply Voltage	3 to 20	V
$V_I$	Input Voltage	0 to $V_{DD}$	V
$T_{op}$	Operating Temperature	-55 to 125	°C

## DC SPECIFICATIONS

Symbol	Parameter	Test Condition				Value						Unit	
		V <sub>I</sub> (V)	V <sub>O</sub> (V)	I <sub>OL</sub>   ( $\mu$ A)	V <sub>DD</sub> (V)	T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
						Min.	Typ.	Max.	Min.	Max.	Min.		Max.
I <sub>L</sub>	Quiescent Current	0/5			5		0.04	5		150		150	$\mu$ A
		0/10			10		0.04	10		300		300	
		0/15			15		0.04	20		600		600	
		0/20			20		0.08	100		3000		3000	
V <sub>OH</sub>	High Level Output Voltage	0/5		<1	5	4.95			4.95		4.95		V
		0/10		<1	10	9.95			9.95		9.95		
		0/15		<1	15	14.95			14.95		14.95		
V <sub>OL</sub>	Low Level Output Voltage	5/0		<1	5		0.05			0.05		0.05	V
		10/0		<1	10		0.05			0.05		0.05	
		15/0		<1	15		0.05			0.05		0.05	
V <sub>IH</sub>	High Level Input Voltage		0.5/4.5	<1	5	3.5			3.5		3.5		V
			1/9	<1	10	7			7		7		
			1.5/13.5	<1	15	11			11		11		
V <sub>IL</sub>	Low Level Input Voltage		4.5/0.5	<1	5			1.5		1.5		1.5	V
			9/1	<1	10			3		3		3	
			13.5/1.5	<1	15			4		4		4	
I <sub>OH</sub>	Output Drive Current	0/5	2.5	<1	5	-1.36	-3.2		-1.1		-1.1		mA
		0/5	4.6	<1	5	-0.44	-1		-0.36		-0.36		
		0/10	9.5	<1	10	-1.1	-2.6		-0.9		-0.9		
		0/15	13.5	<1	15	-3.0	-6.8		-2.4		-2.4		
I <sub>OL</sub>	Output Sink Current	0/5	0.4	<1	5	0.44	1		0.36		0.36		mA
		0/10	0.5	<1	10	1.1	2.6		0.9		0.9		
		0/15	1.5	<1	15	3.0	6.8		2.4		2.4		
I <sub>I</sub>	Input Leakage Current	0/18	Any Input		18		$\pm 10^{-5}$	$\pm 0.1$		$\pm 1$		$\pm 1$	$\mu$ A
C <sub>I</sub>	Input Capacitance		Any Input				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

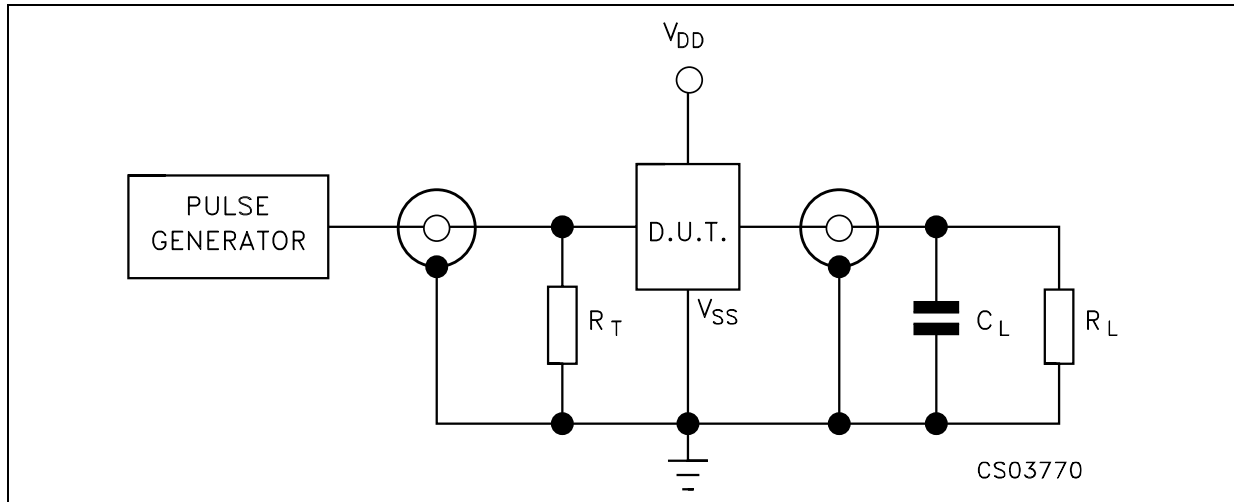
## HCF4520B

### DYNAMIC ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25^{\circ}\text{C}$ , $C_L = 50\text{pF}$ , $R_L = 200\text{K}\Omega$ , $t_r = t_f = 20\text{ ns}$ )

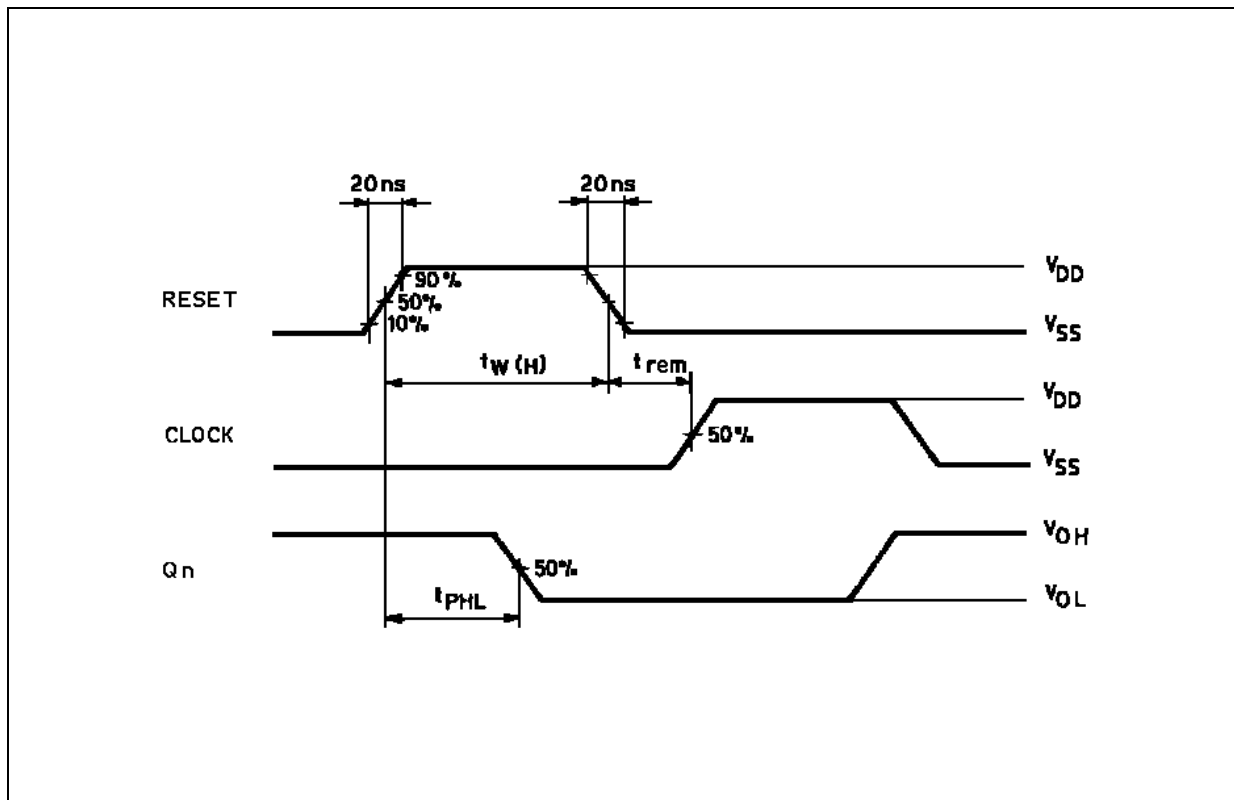
Symbol	Parameter	Test Condition		Value (*)			Unit
		$V_{DD}$ (V)		Min.	Typ.	Max.	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time Clock or Enable to Output	5			280	560	ns
		10			115	230	
		15			80	160	
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time Reset to Output	5			330	650	ns
		10			130	225	
		15			90	170	
$t_{TLH}$ $t_{THL}$	Transition Time	5			100	200	ns
		10			50	100	
		15			40	80	
$t_W$	Clock Pulse Width	5		200	100		ns
		10		100	50		
		15		70	35		
$t_W$	Reset Pulse Width	5		250	125		ns
		10		110	55		
		15		80	40		
$t_W$	Enable Pulse Width	5		400	200		ns
		10		200	100		
		15		140	70		
$t_r$ , $t_f$	Clock or Enable Rise and Fall Time	5				15	$\mu\text{s}$
		10				15	
		15				5	
$f_{MAX}$	Maximum Clock Frequency	5		1.5	3		MHz
		10		3	6		
		15		4	8		
$t_r$ , $t_f$	Clock or Enable Rise and Fall Time	5				15	$\mu\text{s}$
		10				5	
		15				5	

(\*) Typical temperature coefficient for all  $V_{DD}$  value is 0.3 %/°C.

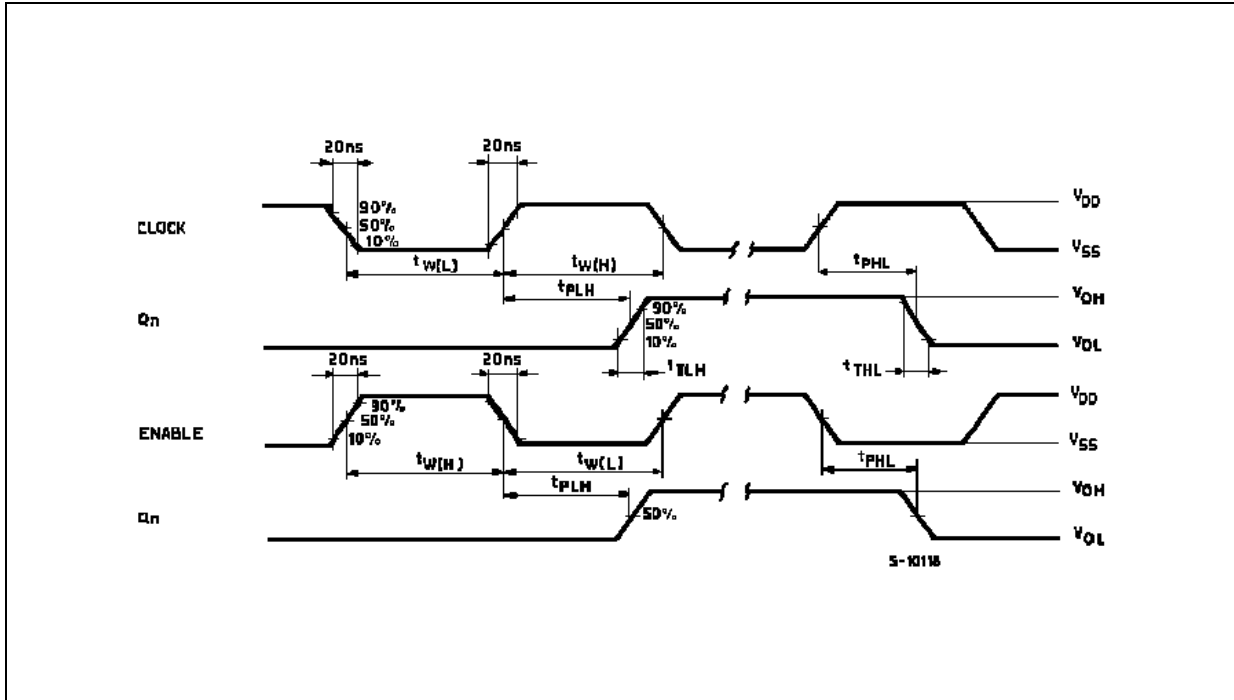
## TEST CIRCUIT



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

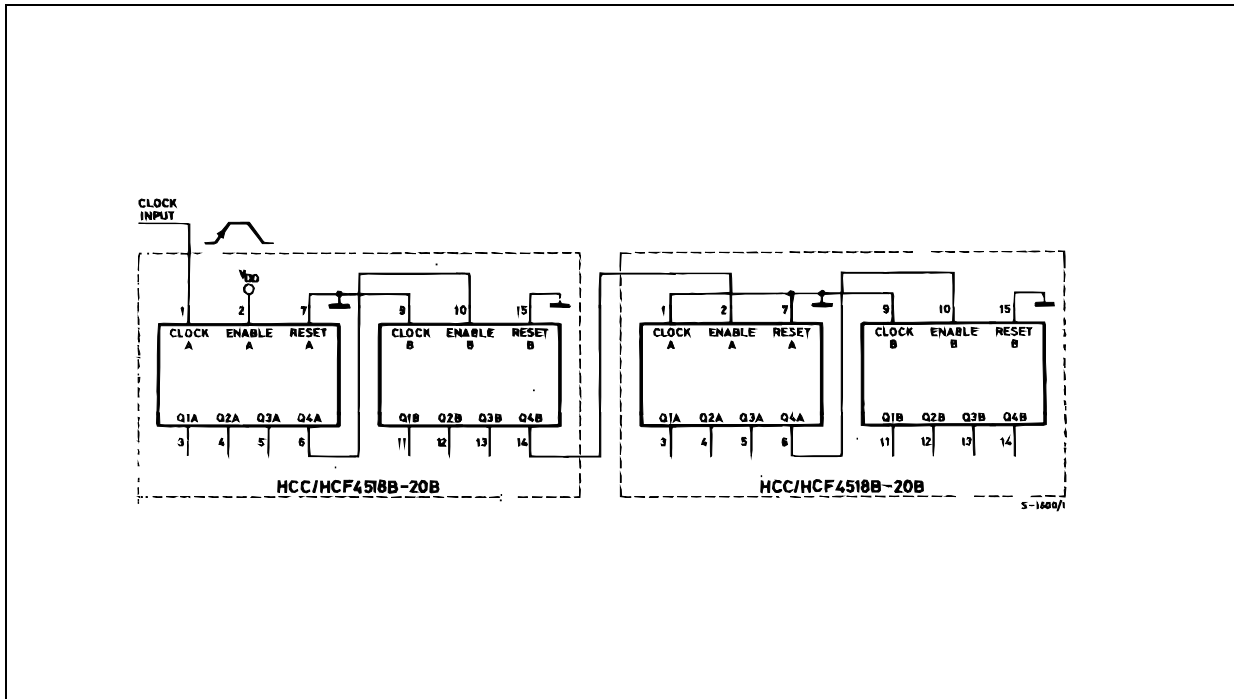
WAVEFORM 1 : MINIMUM PULSE WIDTH AND REMOVAL TIME ( $f=1\text{MHz}$ ; 50% duty cycle)

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



TYPICAL APPLICATION

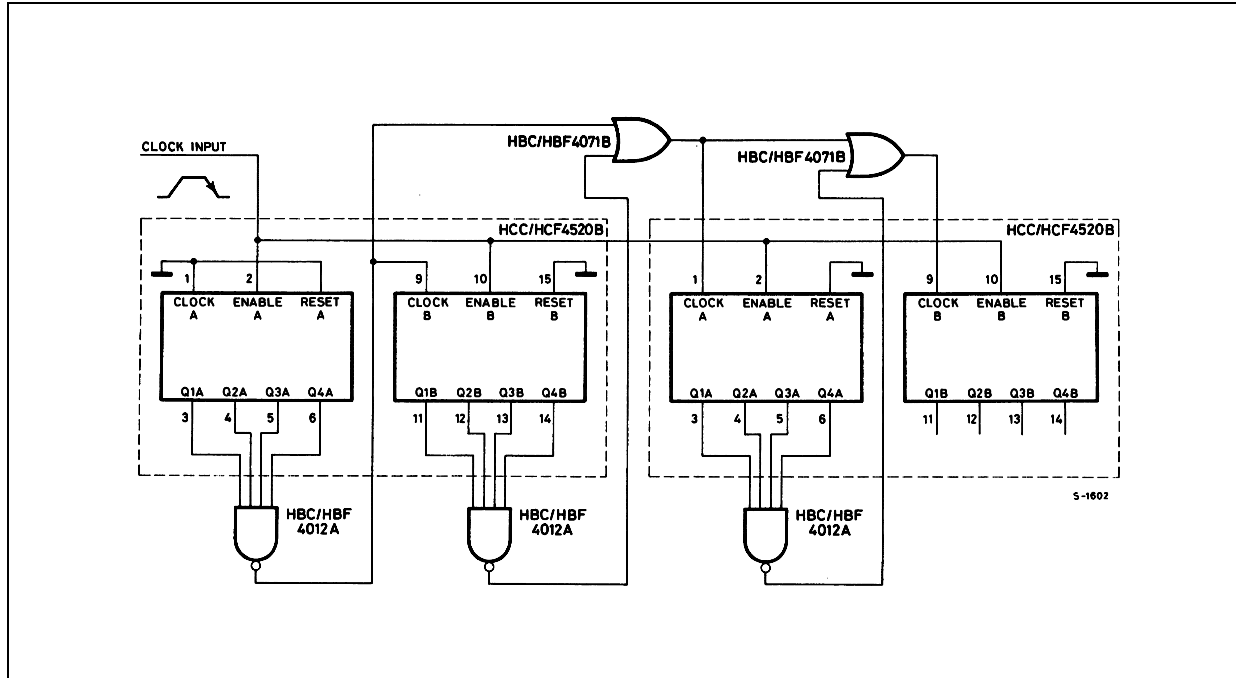
RIPPLE CASCADING OF FOUR COUNTERS WITH POSITIVE-EDGE TRIGGERING





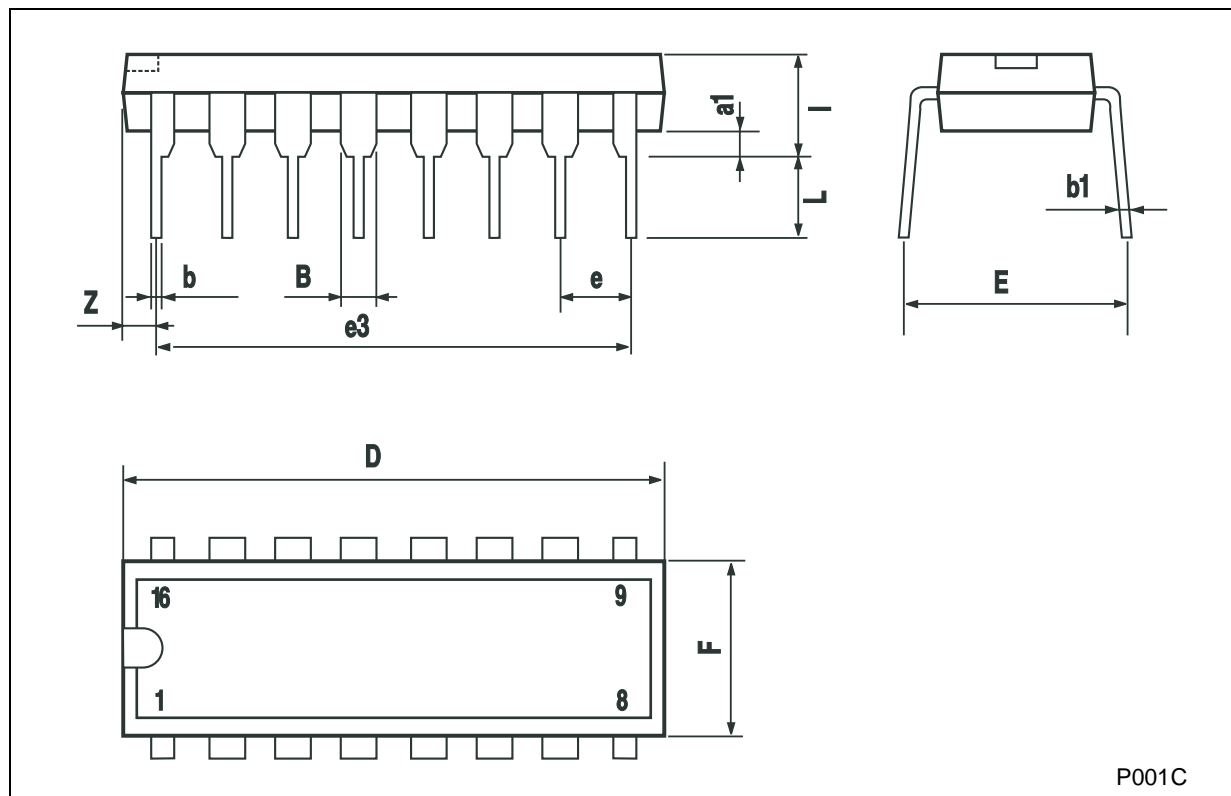
TYPICAL APPLICATION

SYNCHRONOUS CASCAADING OF 4 BINARY COUNTERS WITH NEGATIVE-EDGE TRIGGERING



**Plastic DIP-16 (0.25) MECHANICAL DATA**

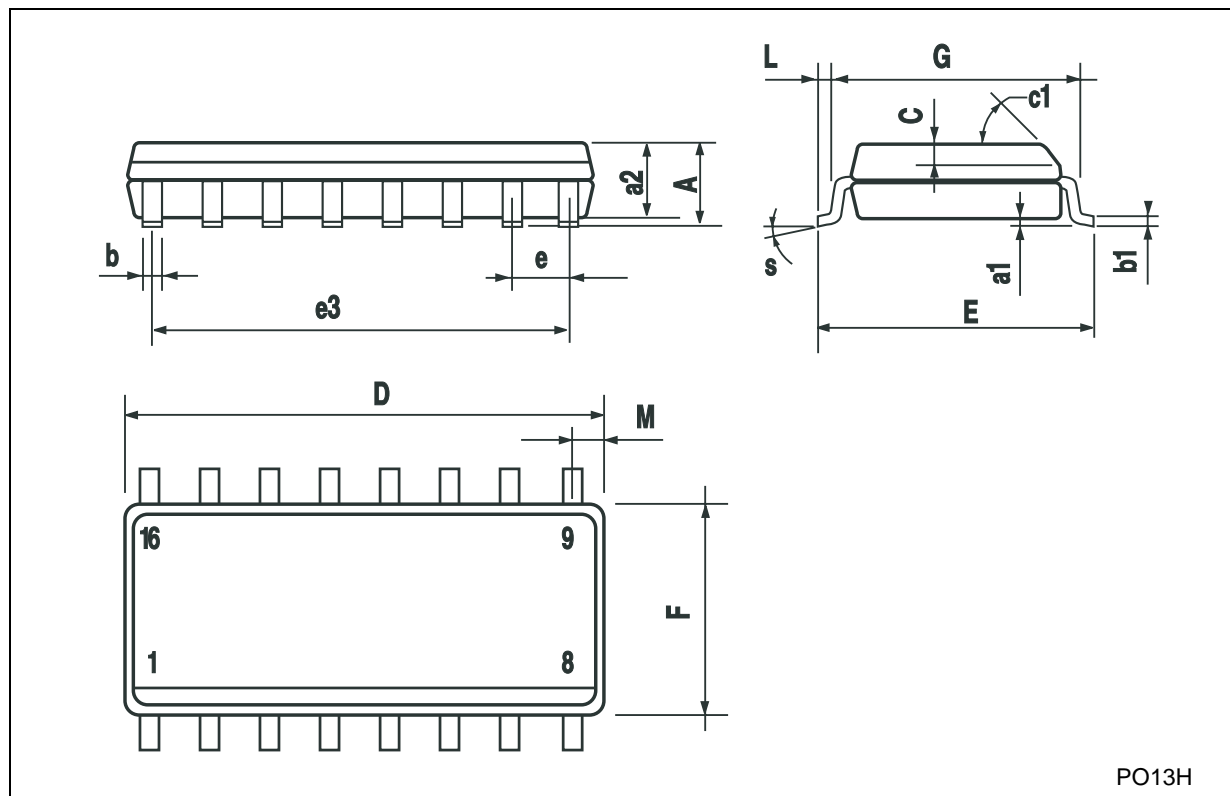
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



P001C

## SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			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
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		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° (max.)					



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