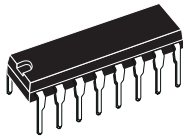
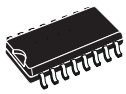
HCF4520B

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



DIP



SOP

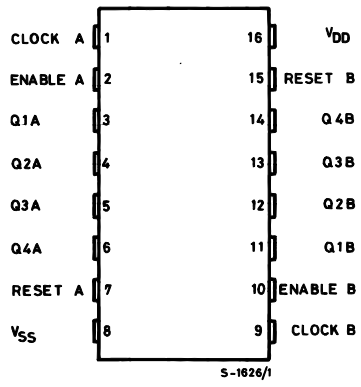
ORDER CODES

PACKAGE	TUBE	T & R
DIP	HCF4520BEY	
SOP	HCF4520BM1	HCF4520M013TR

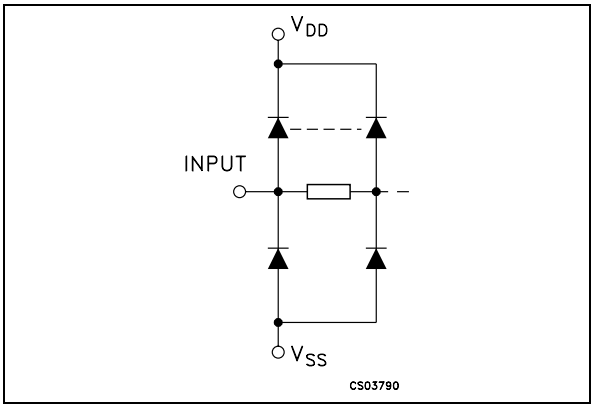
DESCRIPTION

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



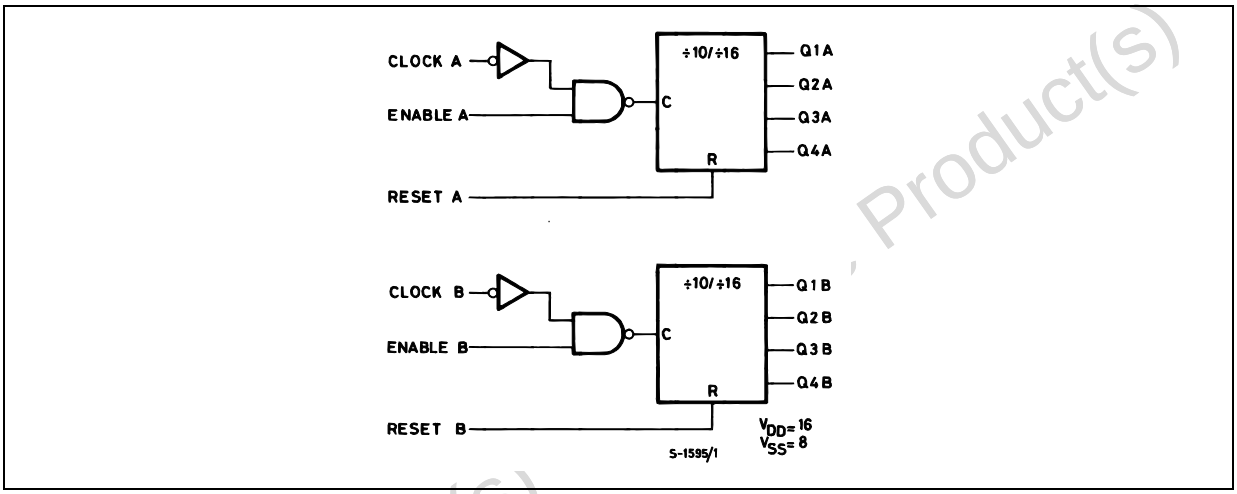
IINPUT EQUIVALENT CIRCUIT



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

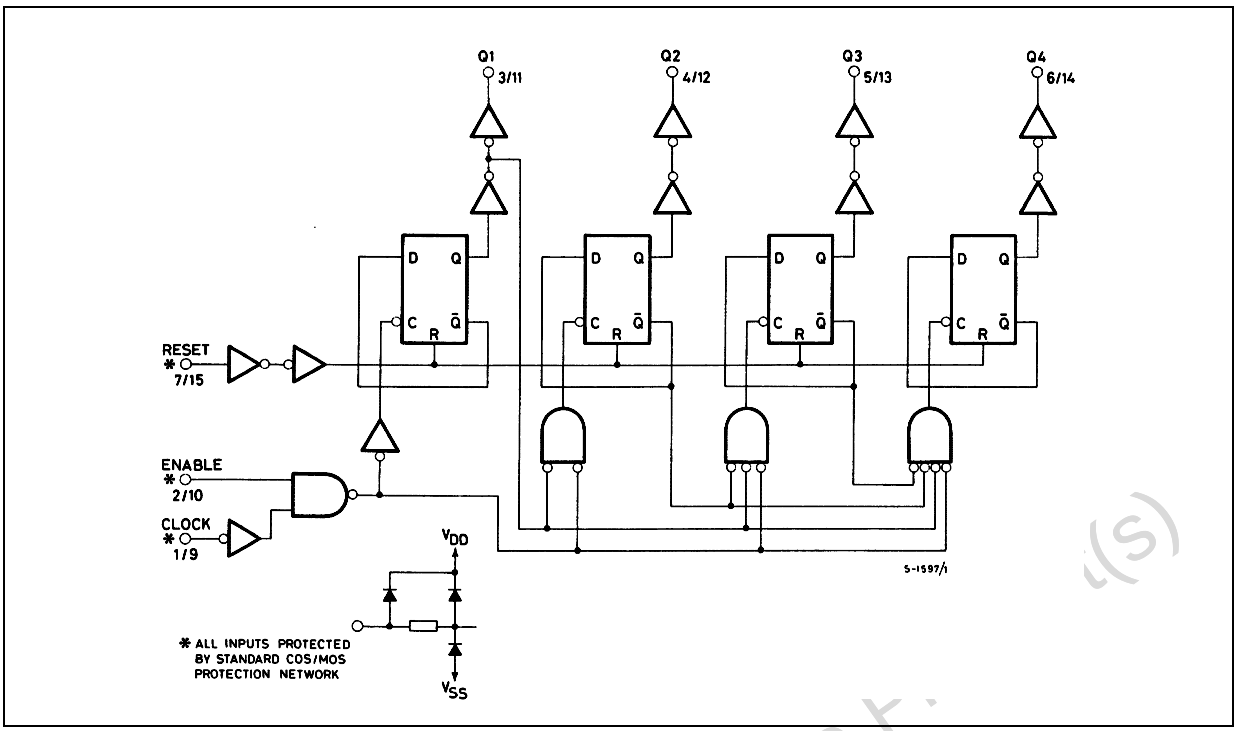


TRUTH TABLE

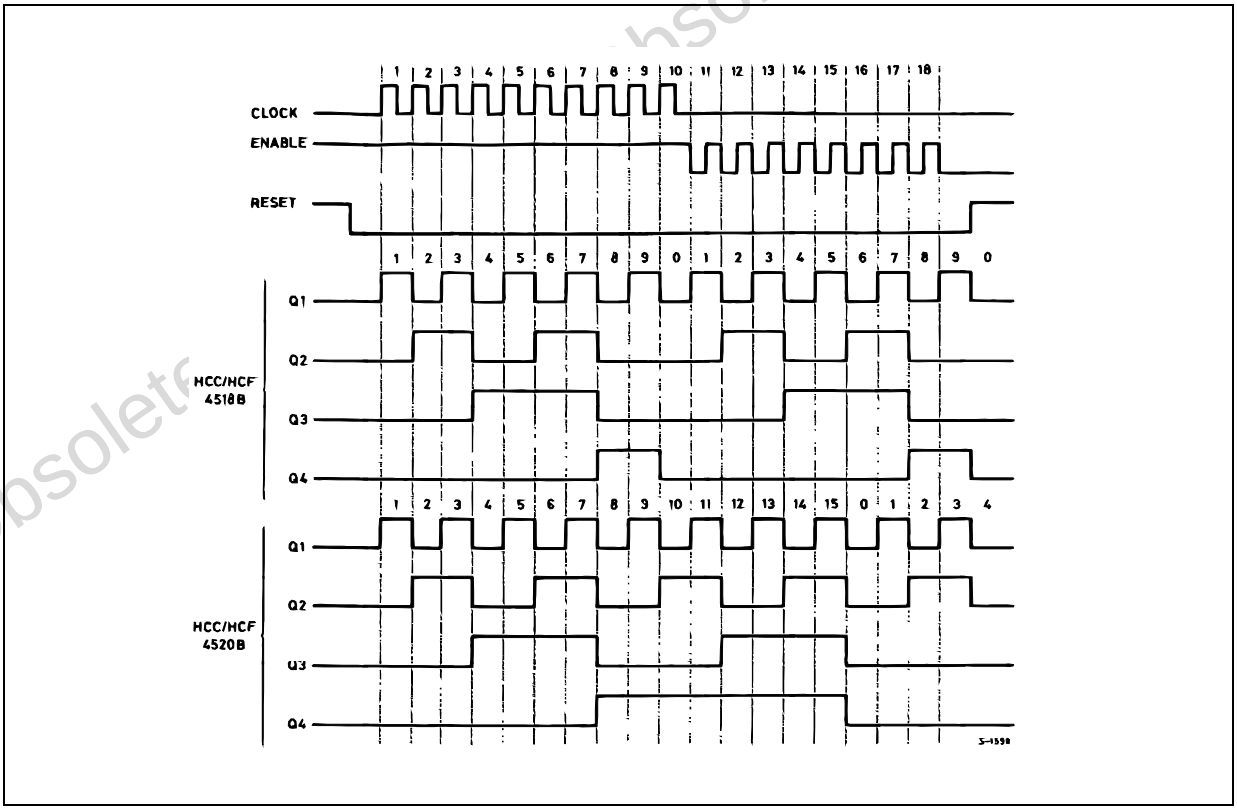
CLOCK	ENABLE	RESET	ACTION
⎍	H	L	INCREMENT COUNTER
L	⎍	L	INCREMENT COUNTER
⎍	X	L	NO CHANGE
X	⎍	L	NO CHANGE
⎍	L	L	NO CHANGE
H	⎍	L	NO CHANGE
X	X	H	Q1 THRU Q4 = 0

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	± 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_I (V)	V_O (V)	$\|I_O\|$ (μA)	V_{DD} (V)	T_A = 25°C			-40 to 85°C		-55 to 125°C		
						Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
I_L	Quiescent Current	0/5			5		0.04	5		150		150	μA
		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_{OH}	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_{OL}	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_{IH}	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_{IL}	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_{OH}	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_{OL}	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_I	Input Leakage Current	0/18	Any Input		18		$\pm 10^{-5}$	±0.1		±1		±1	μA
C_I	Input Capacitance		Any Input				5	7.5					pF

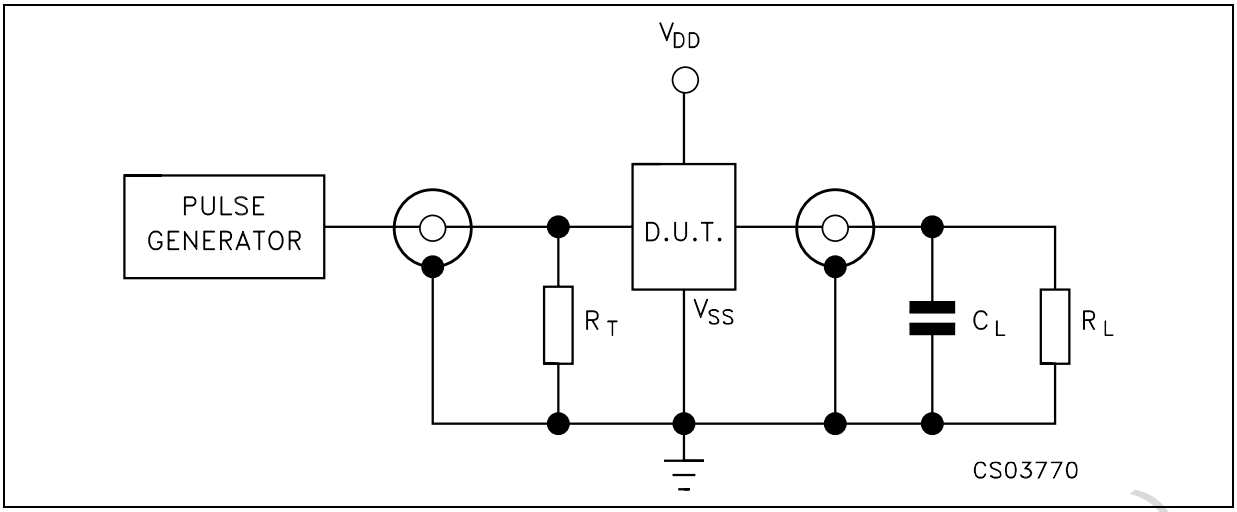
The Noise Margin for both "1" and "0" level is: 1V min. with V_{DD}=5V, 2V min. with V_{DD}=10V, 2.5V min. with V_{DD}=15V

DYNAMIC ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, C_L = 50pF, R_L = 200KΩ, $t_r = t_f$ = 20 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	µs
		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	µs
		10				5	
		15				5	

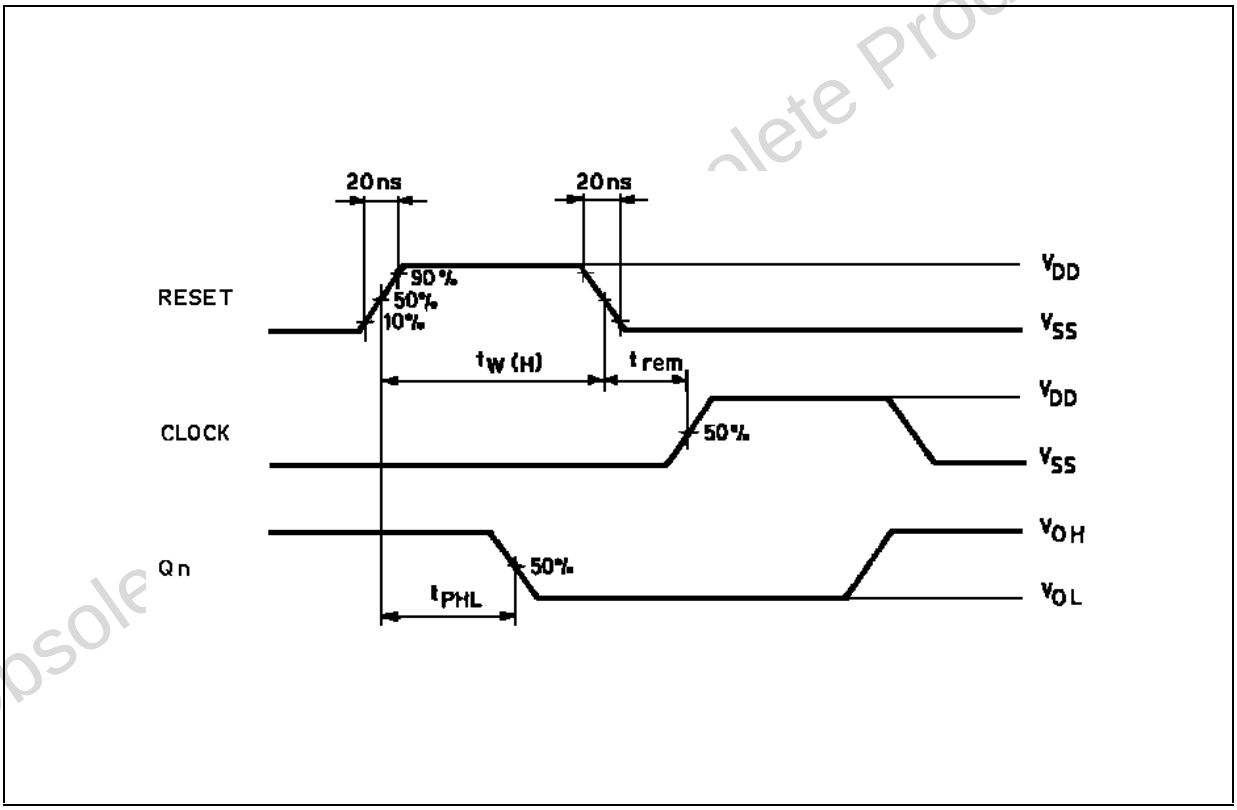
(*) Typical temperature coefficient for all V_{DD} value is 0.3 %/°C.

TEST CIRCUIT

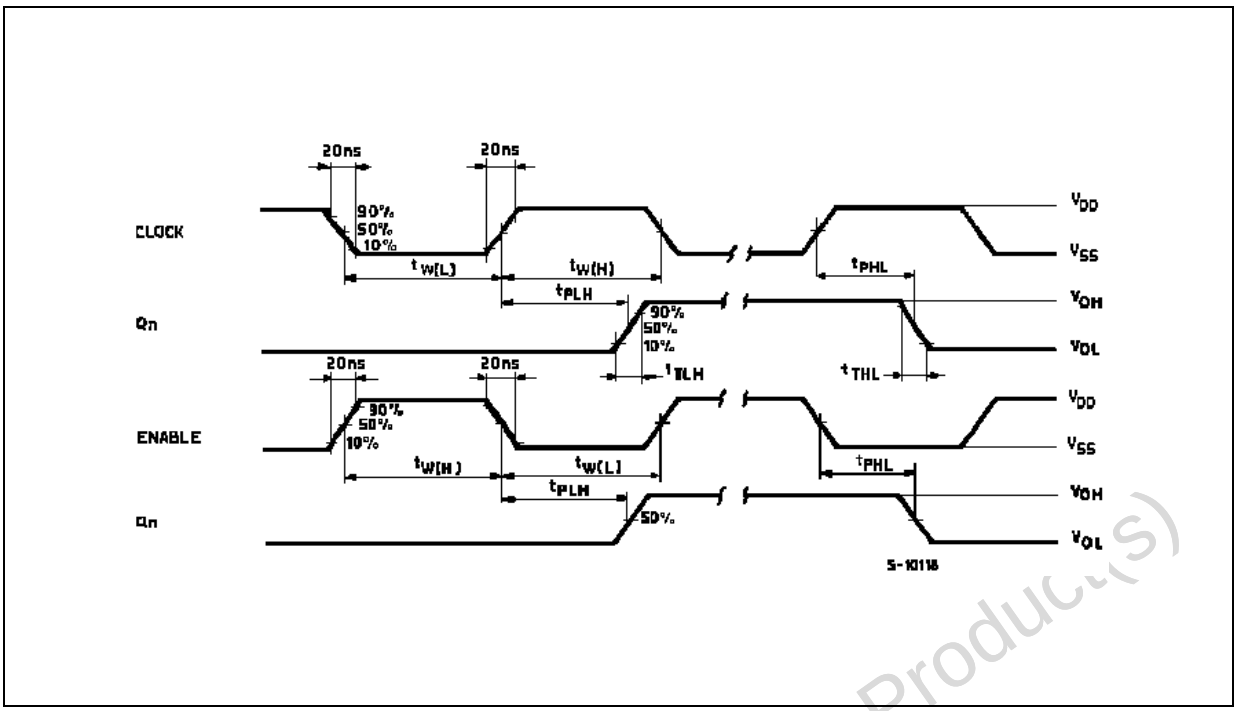


C_L = 50pF or equivalent (includes jig and probe capacitance)
R_L = 200KΩ
R_T = Z_{OUT} of pulse generator (typically 50Ω)

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

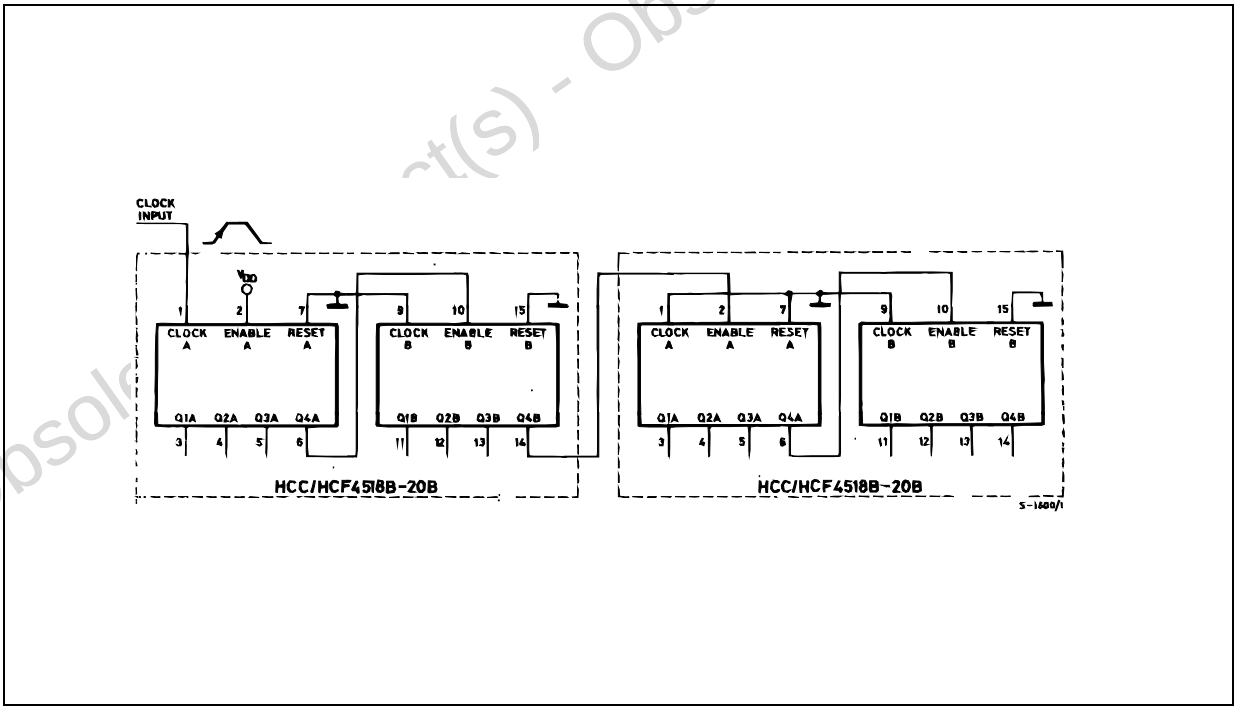


WAVEFORM 2 : PROPAGATION DELAY TIME, MINIMUM PULSE WIDTH (f=1MHz; 50% duty cycle)



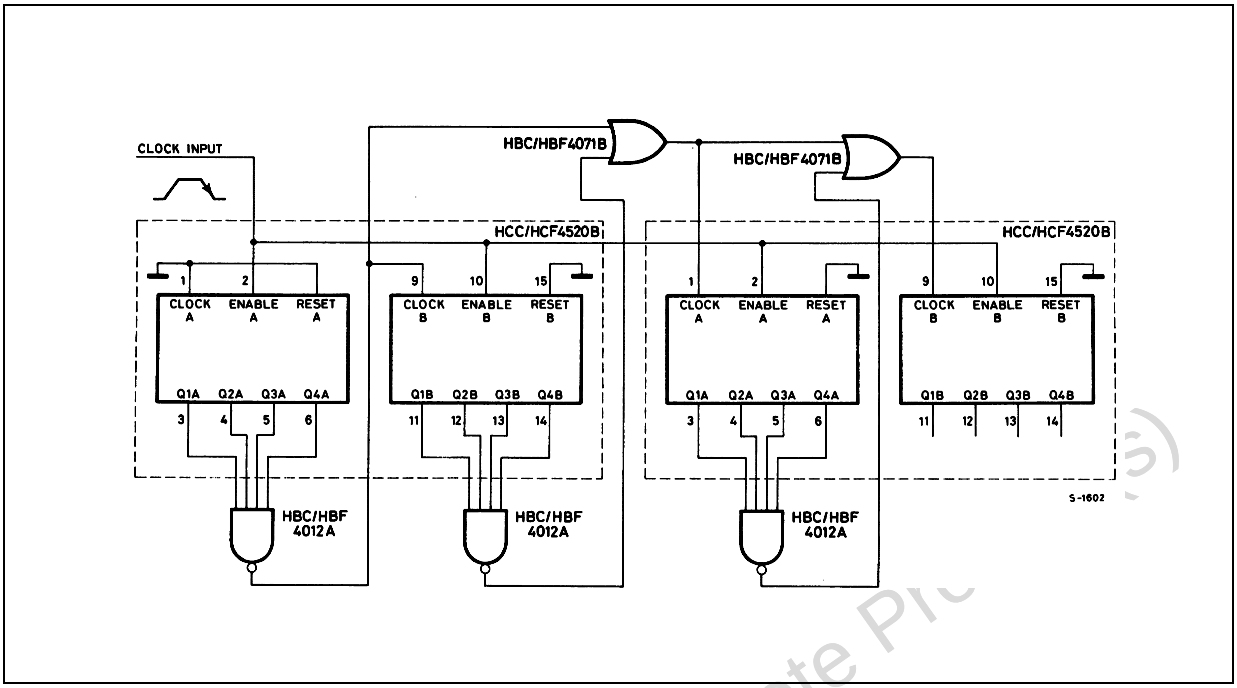
TYPICAL APPLICATION

RIPPLE CASCADING OF FOUR COUNTERS WITH POSITIVE-EDGE TRIGGERING



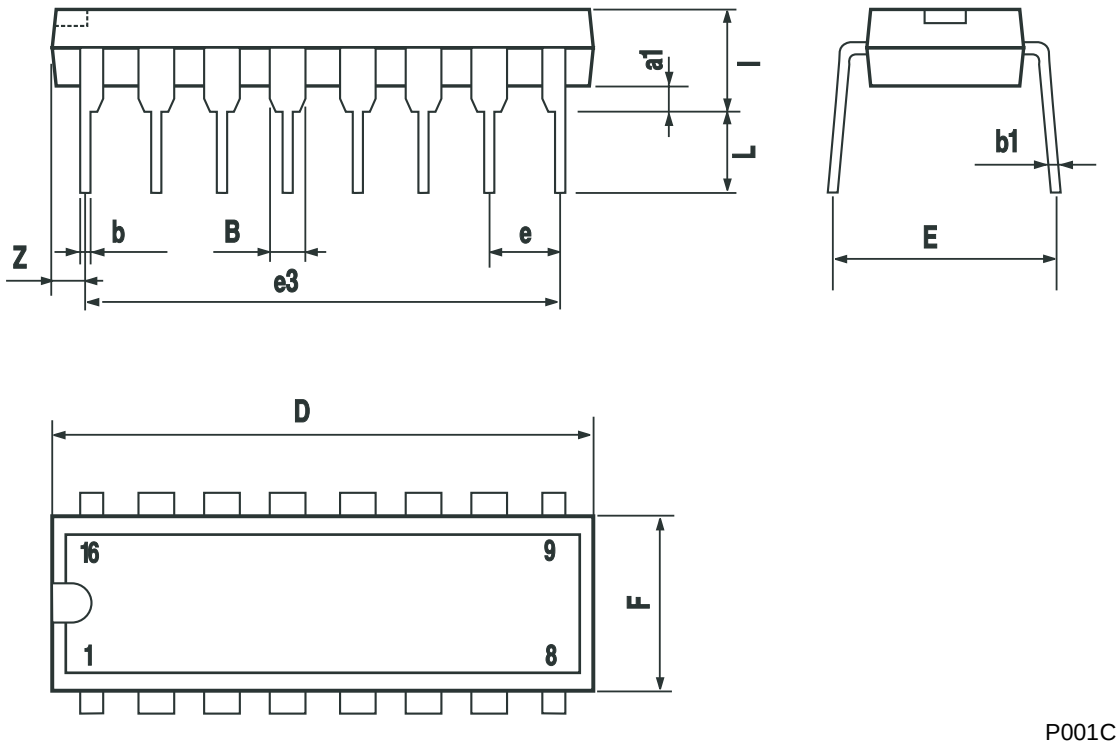
TYPICAL APPLICATION

SYNCHRONOUS CASCADING OF 4 BINARY COUNTERS WITH NEGATIVE-EDGE TRIGGERING



Plastic DIP-16 (0.25) MECHANICAL DATA

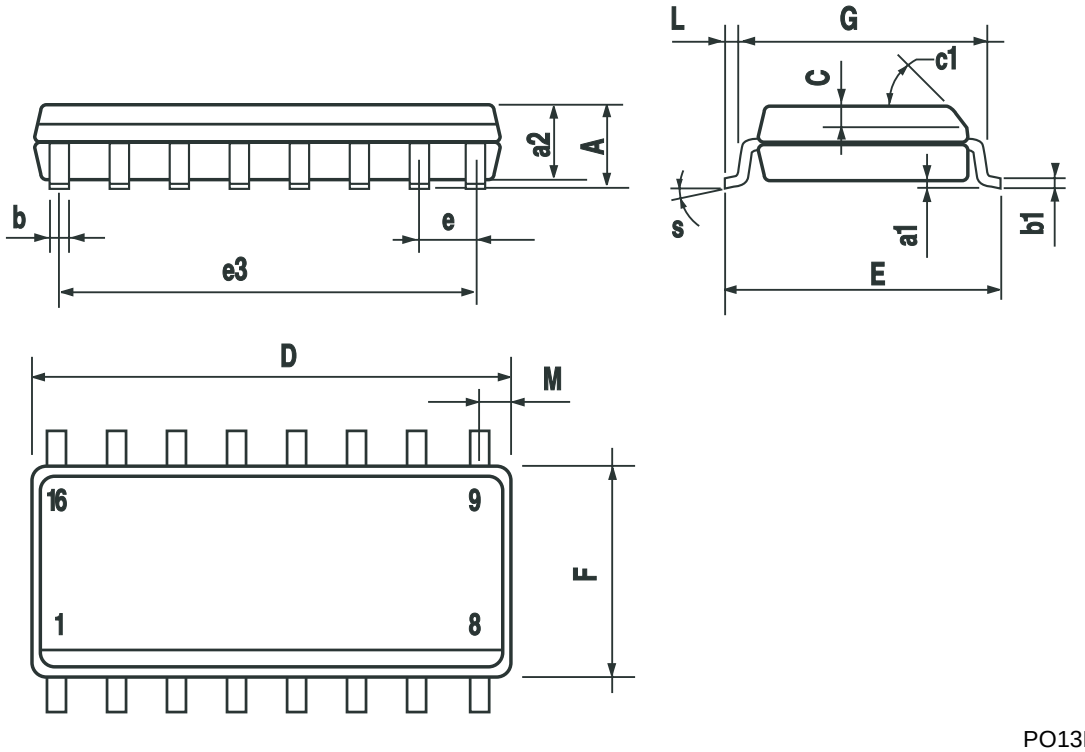
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



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.)					



PO13H