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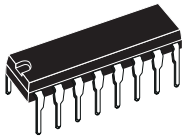
HCF4527B

BCD RATE MULTIPLEXER

- CASCADABLE IN MULTIPLES OF 4-BITS
- SET TO 9 INPUT AND 9 DETECT OUTPUT
- QUIESCENT CURRENT SPECIFIED UP TO 20V
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- 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

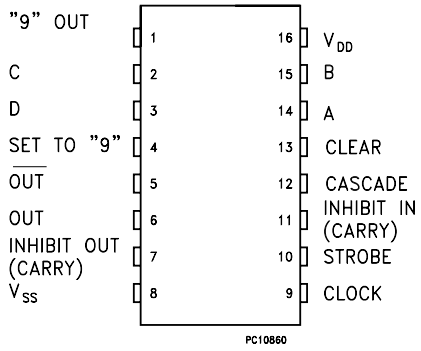
ORDER CODES

PACKAGE	TUBE	T & R
DIP	HCF4527BEY	

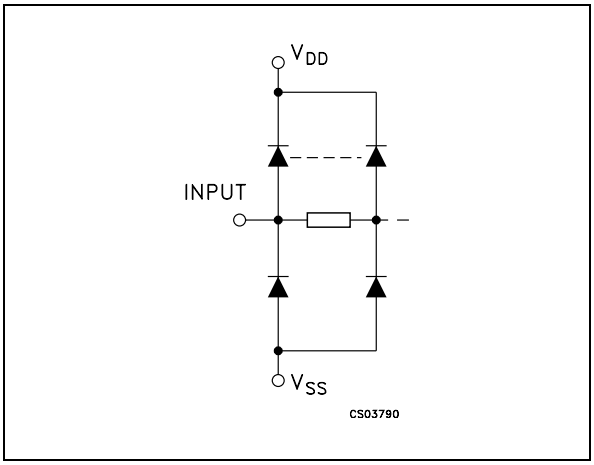
DESCRIPTION

HCF4527B is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP package.
This device is a low power 4-bit digital rate multiplier that provides an output pulse rate which is the clock input pulse rate multiplied by 1/10 times the BCD input. For example, when the BCD input is 8, there will be 8 output pulses for every 10 input pulses. This device may be used to perform arithmetic operations (add, subtract, divide, raise to a power), solve algebraic and differential equations, generate natural logarithms and trigonometric functions, A/D and D/A conversion, and frequency division.

PIN CONNECTION



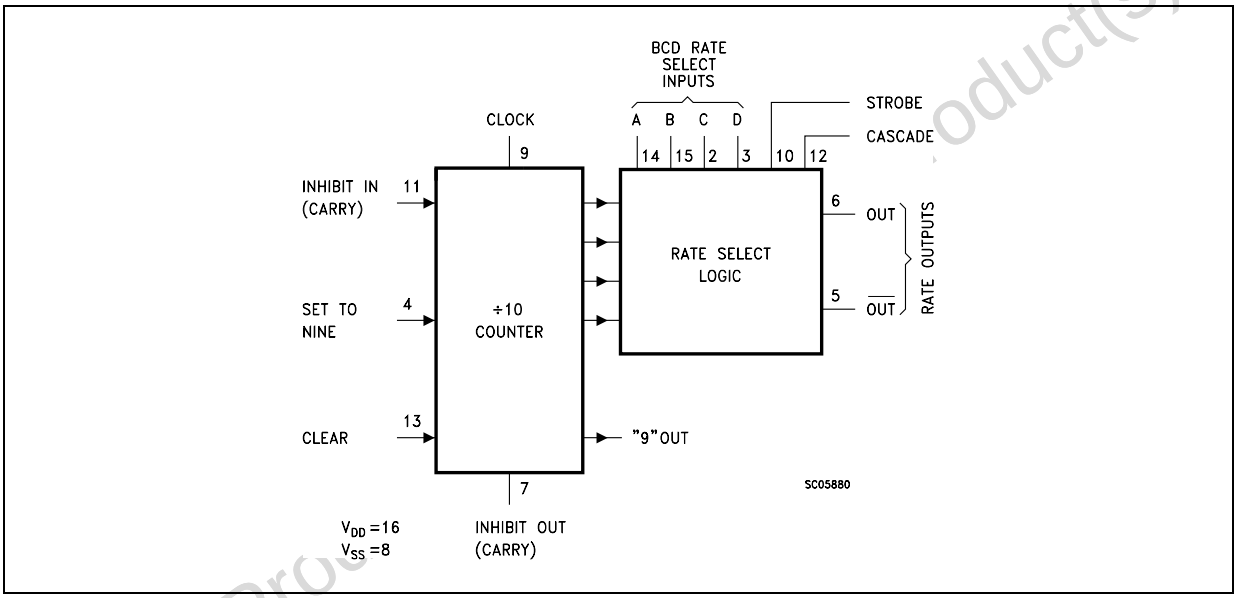
INPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
14, 15, 2, 3	A, B, C, D	BCD Rate Select Inputs
10	STROBE	Strobe Input
12	CASCADE	Cascade
5, 6	$\overline{OUT}$, OUT	Rate Outputs
9	CLOCK	Clock Input
11	INHIBIT IN	Inhibit Input (Carry)
4	SET T0 "9"	Set Input
13	CLEAR	Clear Input
7	INHIBIT OUT	Inhibit Out (Carry)
1	"9" OUT	Output
8	V_{SS}	Negative Supply Voltage
16	V_{DD}	Positive Supply Voltage

FUNCTIONAL DIAGRAM

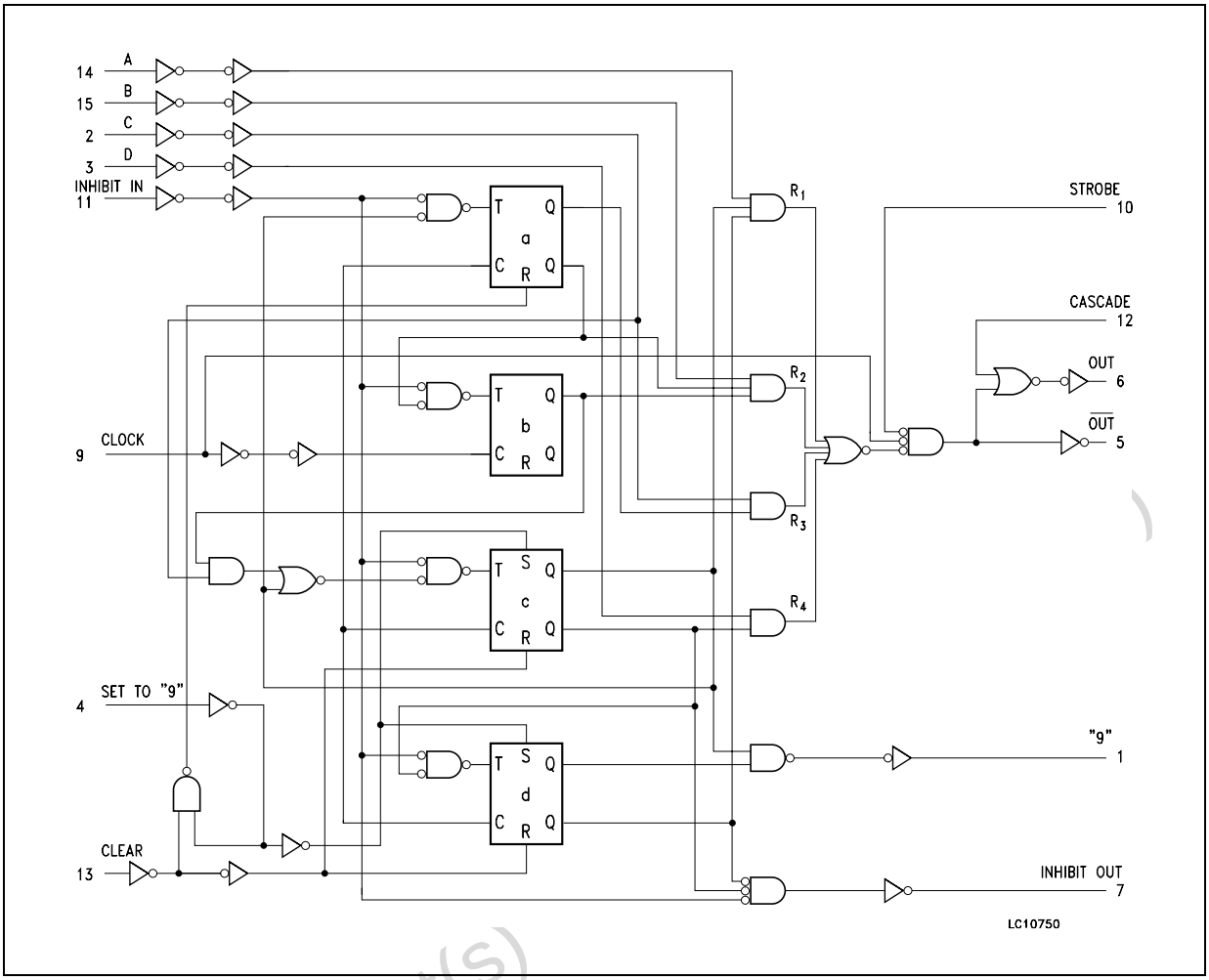


TRUTH TABLE

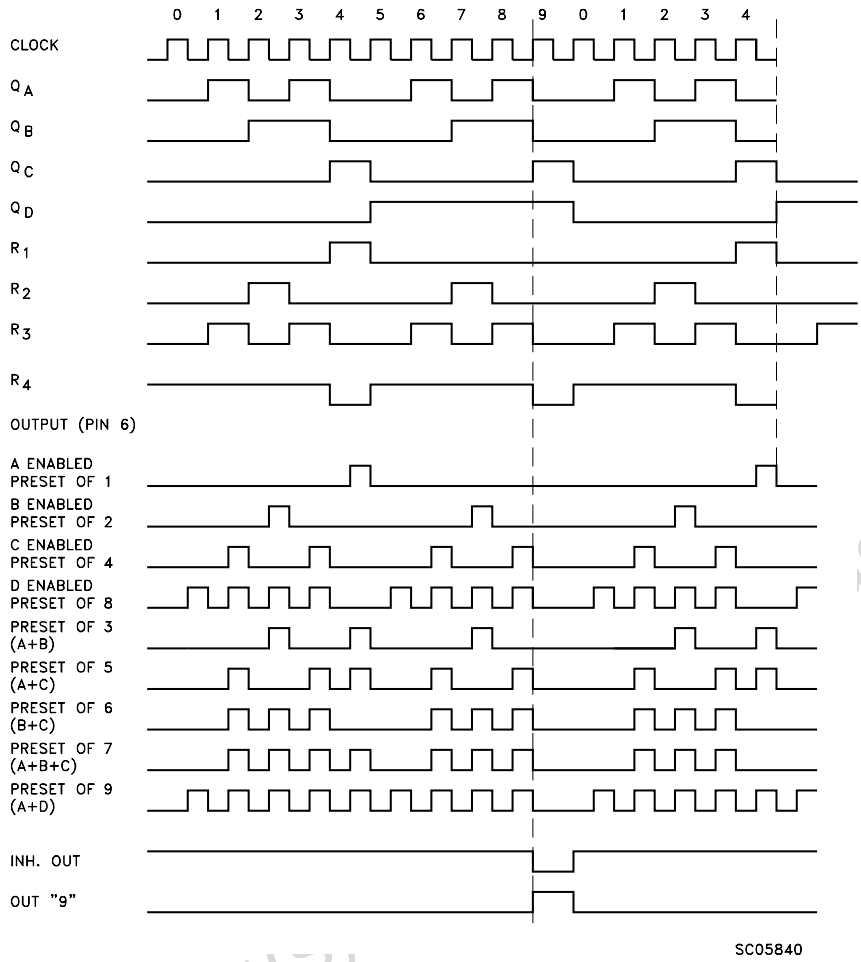
INPUTS										OUTPUTS			
Number of Pulses or Logic Level										Number of Pulses or Output Logic Level			
D	C	B	A	CLK	INH IN	STR	CAS	CLR	SET	OUT	$\overline{\text{OUT}}$	INH OUT	"9" OUT
L	L	L	L	10	L	L	L	L	L	L	H	1	1
L	L	L	H	10	L	L	L	L	L	1	1	1	1
L	L	H	L	10	L	L	L	L	L	2	2	1	1
L	L	H	H	10	L	L	L	L	L	3	3	1	1
L	H	L	L	10	L	L	L	L	L	4	4	1	1
L	H	L	H	10	L	L	L	L	L	5	5	1	1
L	H	H	L	10	L	L	L	L	L	6	6	1	1
L	H	H	H	10	L	L	L	L	L	7	7	1	1
H	L	L	L	10	L	L	L	L	L	8	8	1	1
H	L	L	H	10	L	L	L	L	L	9	9	1	1
H	L	H	L	10	L	L	L	L	L	8	8	1	1
H	L	H	H	10	L	L	L	L	L	9	9	1	1
H	H	L	L	10	L	L	L	L	L	8	8	1	1
H	H	L	H	10	L	L	L	L	L	9	9	1	1
H	H	H	L	10	L	L	L	L	L	8	8	1	1
H	H	H	H	10	H	L	L	L	L	9	9	1	1
X	X	X	X	10	L	H	L	L	L	**	**	H	**
X	X	X	X	10	L	L	L	L	L	L	H	1	1
X	X	X	X	10	L	L	H	L	L	H	*	1	1
H	X	X	X	10	L	L	L	H	L	10	10	H	L
L	X	X	X	10	L	L	L	H	L	L	H	H	L
X	X	X	X	10	L	L	L	L	H	L	H	L	H

X : Don't Care
** : Depends on internal state of counter.
* : Output same as the first 16 lines of this truth table (depending on value of A, B, C, D)

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 (Source) Q, Q, Q' CL_D	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 Q	0/5	0.4	<1	5	1.74	4		1.43		1.43		mA
		0/10	0.5	<1	10	4.42	10.4		3.74		3.74		
		0/15	1.5	<1	15	11.56	27.2		9.52		9.52		
I_{OL}	Output Sink Current Q, Q', CL_D	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 to Output	5			110	220	ns
		10			55	110	
		15			45	90	
t_{PLH}, t_{PHL}	Propagation Delay Time : Clock or Strobe to Output	5			150	300	ns
		10			75	150	
		15			60	120	
t_{PLH}	Propagation Delay Time : Clock to Inhibit Output	5			320	640	ns
		10			145	290	
		15			100	200	
t_{PHL}	Propagation Delay Time : Clock to Inhibit Output	5			250	500	ns
		10			100	200	
		15			75	150	
t_{PLH}, t_{PHL}	Propagation Delay Time : Clear to Output	5			380	760	ns
		10			175	550	
		15			130	260	
t_{PLH}, t_{PHL}	Propagation Delay Time : Clock to "9" or "1" Q Output	5			300	600	ns
		10			125	250	
		15			90	180	
t_{PLH}, t_{PHL}	Propagation Delay Time : Cascade to Output	5			90	180	ns
		10			45	90	
		15			35	70	
t_{PLH}, t_{PHL}	Propagation Delay Time : Inhibit Input to Inhibit Output	5			130	260	ns
		10			60	120	
		15			45	90	
t_{PLH}, t_{PHL}	Propagation Delay Time : Set to Output	5			330	660	ns
		10			150	300	
		15			110	220	
t_{THL}, t_{TLH}	Transition Time	5			100	200	ns
		10			50	100	
		15			40	80	
f_{CL}	Maximum Clock Frequency	5		1.2	2.4		MHz
		10		2.5	5		
		15		3.5	7		
t_W	Clock Pulse Width	5		330	165		ns
		10		170	85		
		15		100	50		
t_r, t_f	Clock Rise or Fall Time	5				15	µs
		10				15	
		15				15	
t_W	Set or Clear Pulse Width	5		160	80		ns
		10		90	45		
		15		60	30		
t_{setup}	Inhibit Input Setup Time	5		100	50		ns
		10		40	20		
		15		20	10		

Symbol	Parameter	Test Condition		Value (*)			Unit
		V_{DD} (V)		Min.	Typ.	Max.	
t_R	Inhibit Input Removal Time	5		240	120		ns
		10		130	65		
		15		110	55		
t_R	Set Removal Time	5		150	75		ns
		10		80	40		
		15		50	25		
t_R	Clear Removal Time	5		60	30		ns
		10		40	20		
		15		30	15		

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

APPLICATION NOTE :

For fractional multipliers with more than one digit, HCF4527B may be cascaded in two different modes: The ADD mode and the MULTIPLY mode (see figure 1 and 2).

When two units are cascaded in ADD mode and programmed to 9 and 4 respectively, the more significant unit will have 9 output pulses for every 10 input pulses and the other will have 4 output pulses for every 100 input pulses for a total of :

$$\frac{9}{10}+\frac{4}{100}=\frac{94}{100}$$

In the multiply mode, the fraction programmed into the first rate multiplier is multiplied by the fraction programmed into the second one :

If $N_1 = 9$ and $N_2 = 4$

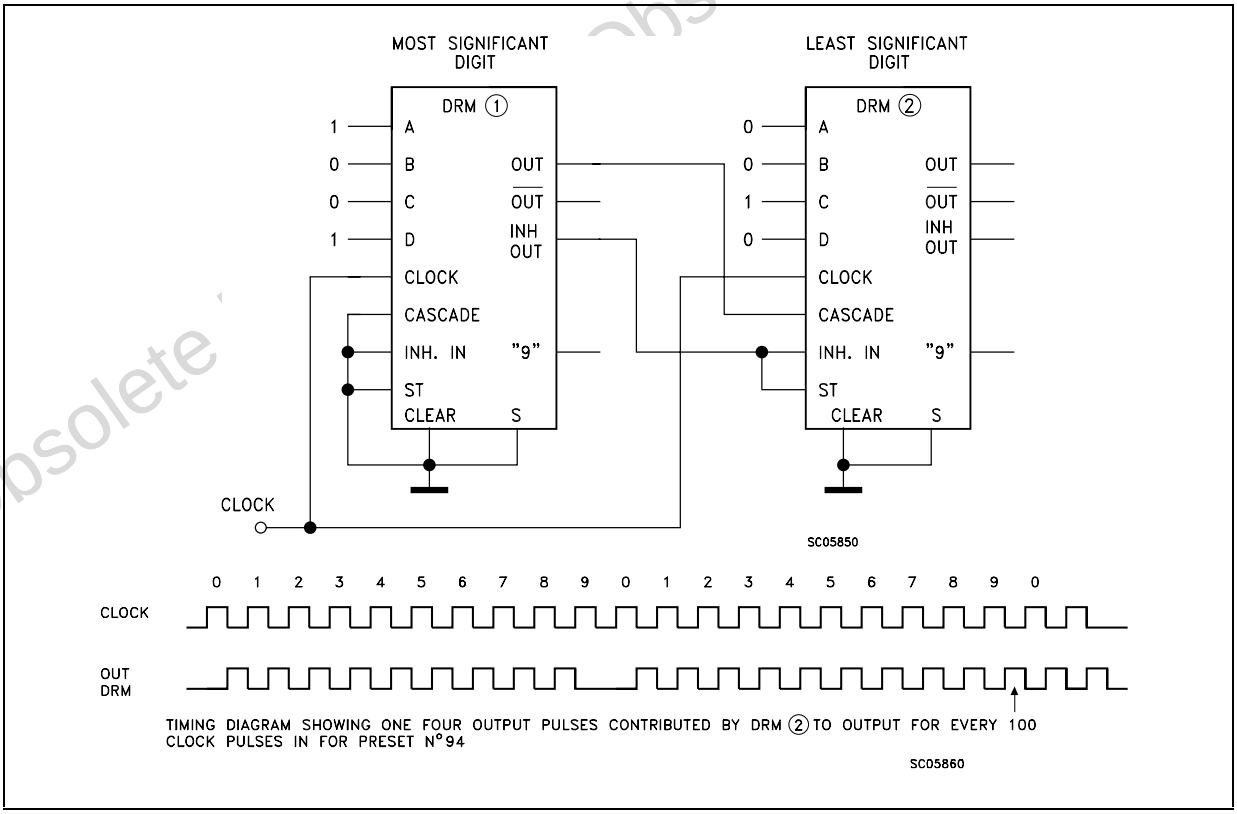
$$f_{OUT2}=\frac{4}{10}\ f_{OUT1}$$

$$f_{OUT1}=\frac{9}{10}\ f_{CLOCK}$$

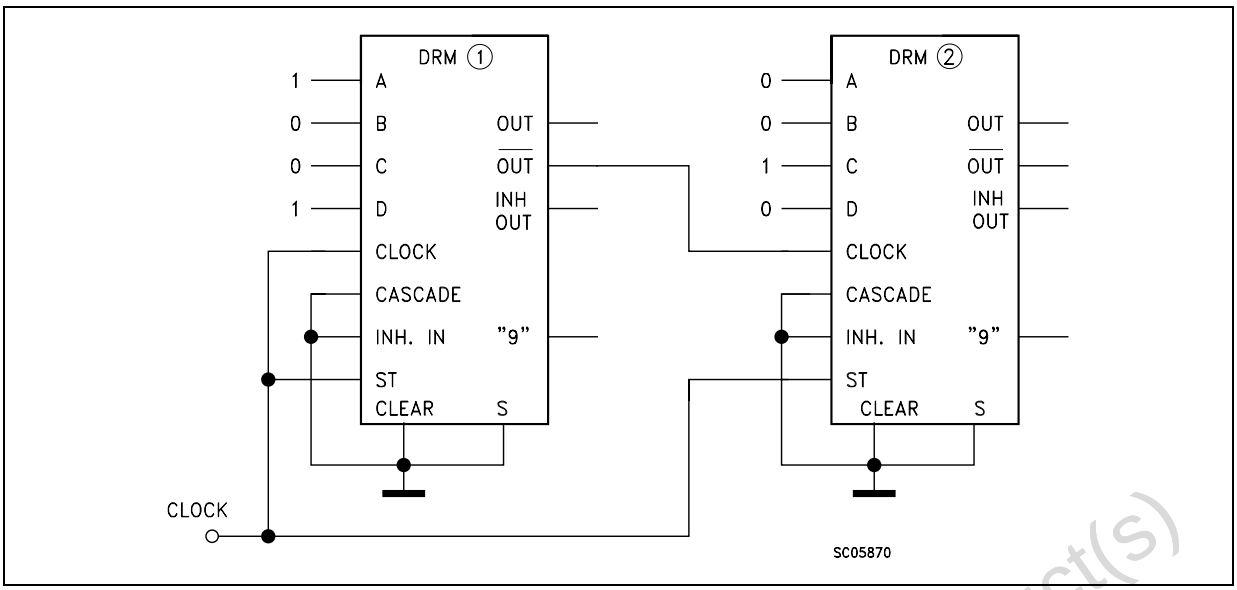
$$f_{OUT2}=\frac{4}{10}\ x\ (\frac{9}{10}\ f_{CLOCK})=\frac{36}{100}\ f_{CLOCK}$$

Therefore 36 output pulses for every 100 clock input pulses

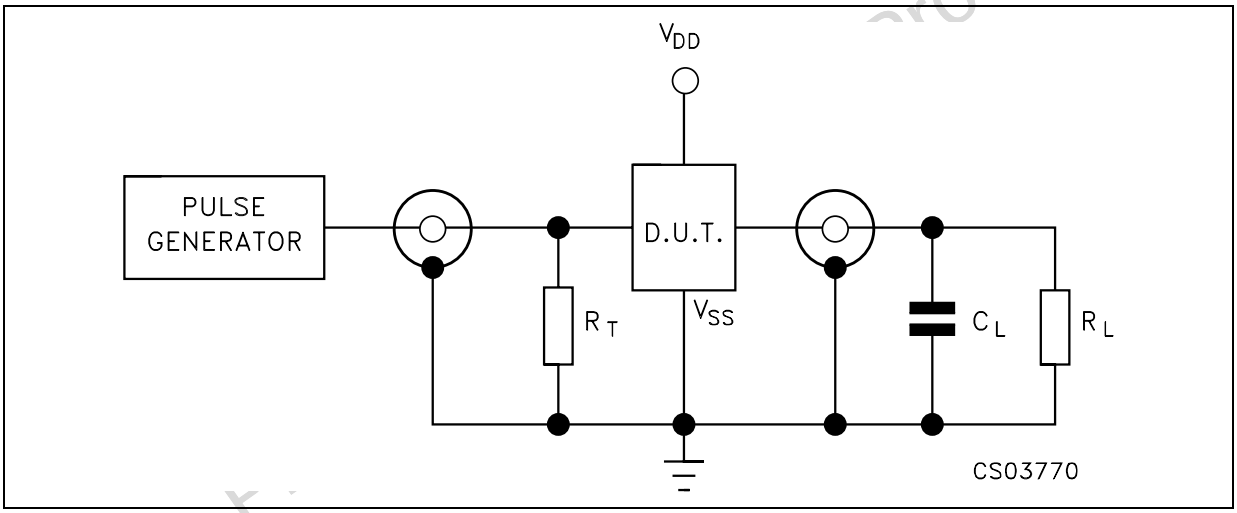
Two HCF4527B Cascaded in the ADD mode with a Preset Number



Two HCF4527B Cascaded in the MULTIPLY Mode with a Preset Number

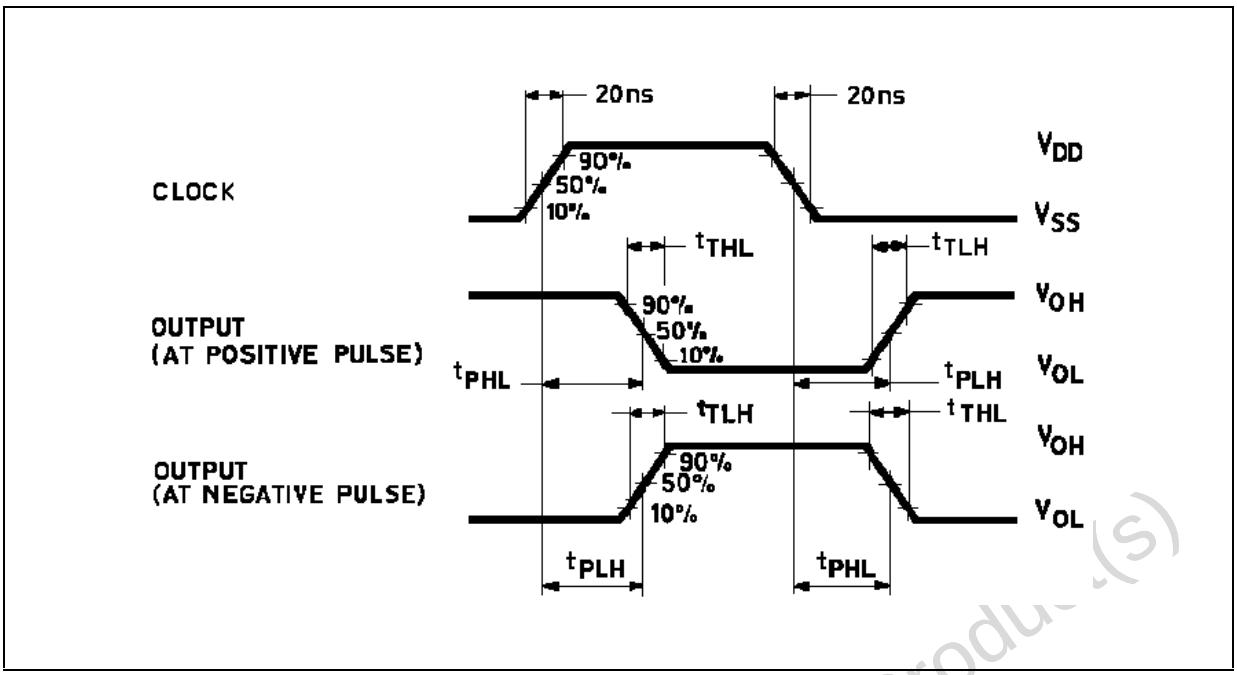


TEST CIRCUIT



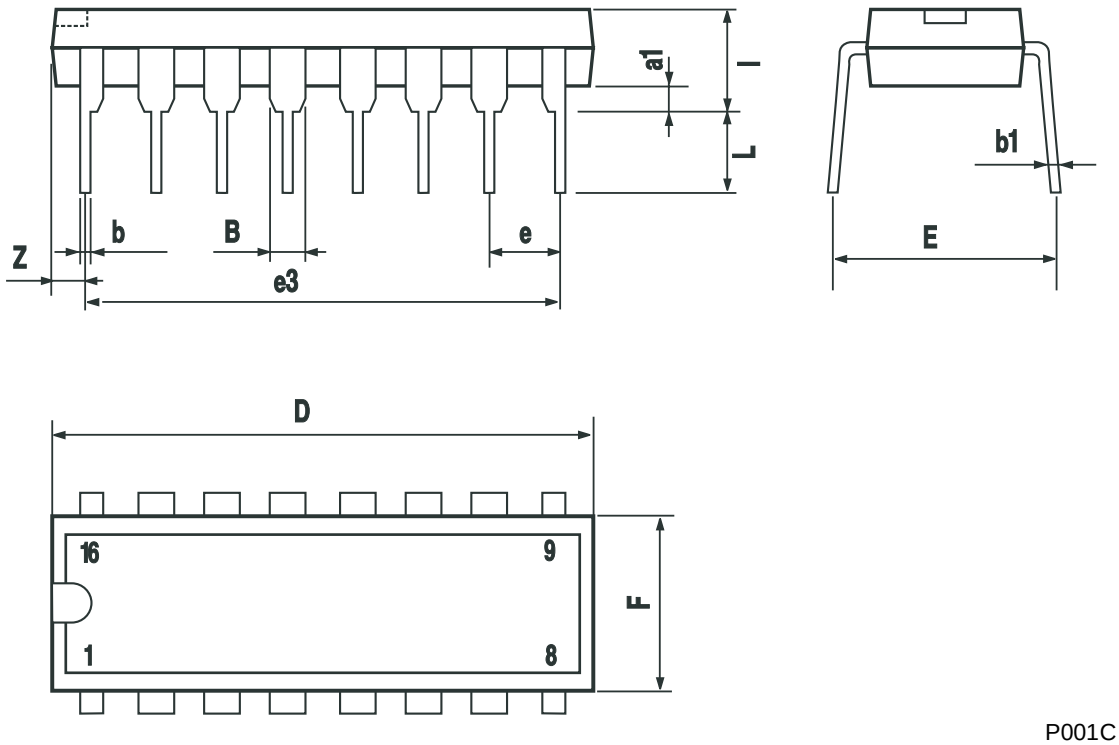
C_L = 50pF or equivalent (includes jig and probe capacitance)
R_L = 200KΩ
R_T = Z_{OUT} of pulse generator (typically 50Ω)

WAVEFORM : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



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



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