

# HD74HC490

## Dual 4-bit Decade Counters

# HITACHI

ADE-205-507 (Z)  
1st. Edition  
Sep. 2000

### Description

This circuit contains eight master-slave flip-flops and additional gating to implement two individual 4-bit decade counters. Each decade counter has individual clock, clear and set-to-9 inputs. BCD count sequences of any length up to divide-by-100 may be implemented with a single HD74HC490. Buffering on each output is provided to ensure that susceptibility to collector communication is reduced significantly. The counters have parallel outputs from each counter state so that submultiples of the input count frequency are available for system timing signals.

### Features

- High Speed Operation:  $t_{pd}$  (Clock to  $Q_A$ ) = 13 ns typ ( $C_L = 50$  pF)
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage:  $V_{CC} = 2$  to 6 V
- Low Input Current: 1  $\mu$ A max
- Low Quiescent Supply Current:  $I_{CC}$  (static) = 4  $\mu$ A max ( $T_a = 25^\circ\text{C}$ )

### Function Table

#### Clear/Set-To-9

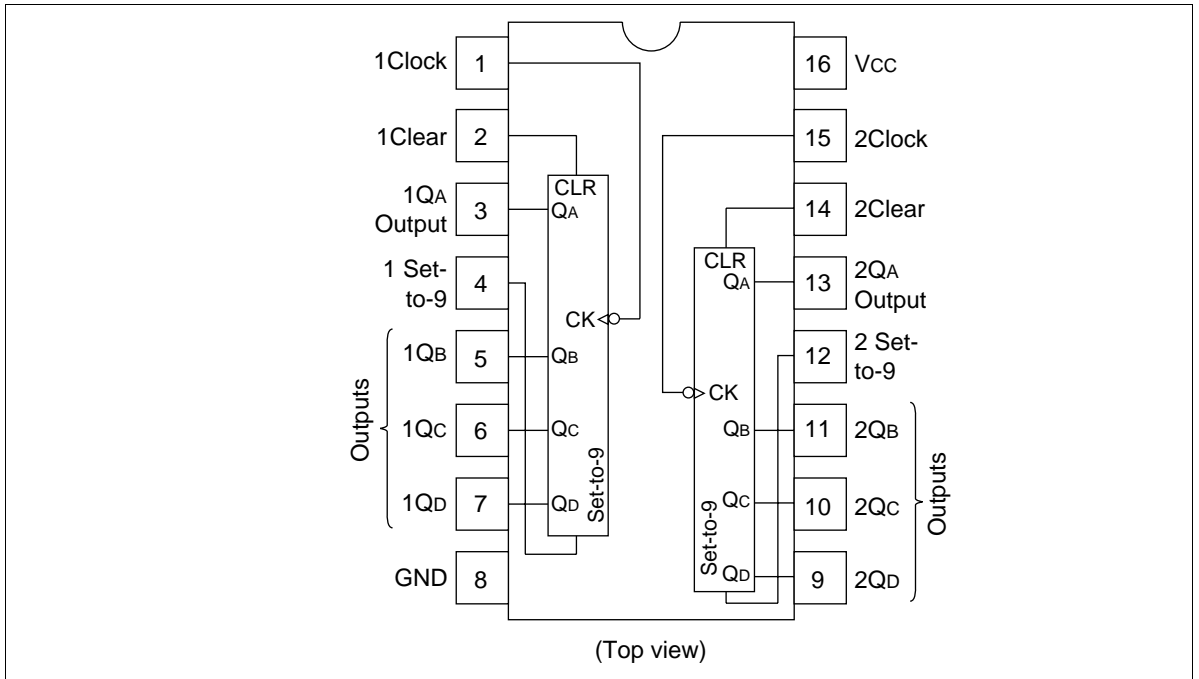
Inputs		Outputs			
Clear	Set-To-9	$Q_A$	$Q_B$	$Q_C$	$Q_D$
H	L	L	L	L	L
L	H	H	L	L	H
L	L	Count			

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## BCD Count Sequence

Count	Outputs			
	Q <sub>D</sub>	Q <sub>C</sub>	Q <sub>B</sub>	Q <sub>A</sub>
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H

## Pin Arrangement



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**DC Characteristics**

Item	Symbol	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to +85°C		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Input voltage	V <sub>IH</sub>	2.0	1.5	—	—	1.5	—	V		
		4.5	3.15	—	—	3.15	—			
		6.0	4.2	—	—	4.2	—			
	V <sub>IL</sub>	2.0	—	—	0.5	—	0.5	V		
		4.5	—	—	1.35	—	1.35			
		6.0	—	—	1.8	—	1.8			
Output voltage	V <sub>OH</sub>	2.0	1.9	2.0	—	1.9	—	V	Vin = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -20 μA	
		4.5	4.4	4.5	—	4.4	—			
		6.0	5.9	6.0	—	5.9	—			
		4.5	4.18	—	—	4.13	—			I <sub>OH</sub> = -4 mA
		6.0	5.68	—	—	5.63	—			I <sub>OH</sub> = -5.2 mA
	V <sub>OL</sub>	2.0	—	0.0	0.1	—	0.1	V	Vin = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 20 μA	
		4.5	—	0.0	0.1	—	0.1			
		6.0	—	0.0	0.1	—	0.1			
		4.5	—	—	0.26	—	0.33			I <sub>OL</sub> = 4 mA
		6.0	—	—	0.26	—	0.33			I <sub>OL</sub> = 5.2 mA
Input current	I <sub>in</sub>	6.0	—	—	±0.1	—	±1.0	μA	Vin = V <sub>CC</sub> or GND	
Quiescent supply current	I <sub>CC</sub>	6.0	—	—	4.0	—	40	μA	Vin = V <sub>CC</sub> or GND, I <sub>out</sub> = 0 μA	

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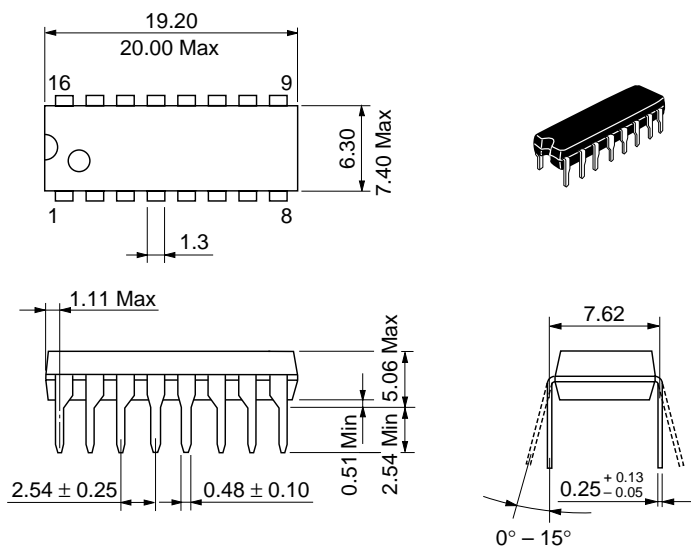
## AC Characteristics ( $C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$		$T_a = -40$ to $+85^\circ\text{C}$		Unit	Test Conditions	
			Min	Typ	Max	Min			Max
Maximum clock frequency	$f_{max}$	2.0	—	—	4	—	3	MHz	
		4.5	—	—	20	—	16		
		6.0	—	—	24	—	19		
Propagation delay time	$t_{PLH}$	2.0	—	—	120	—	150	ns	Clock to $Q_A$
		4.5	—	13	24	—	30		
		6.0	—	—	20	—	26		
	$t_{PHL}$	2.0	—	—	205	—	255	ns	Clock to $Q_B$ , $Q_C$
		4.5	—	21	41	—	51		
		6.0	—	—	35	—	43		
	$t_{PLH}$	2.0	—	—	280	—	350	ns	Clock to $Q_C$
		4.5	—	23	56	—	70		
		6.0	—	—	48	—	60		
	$t_{PHL}$	2.0	—	—	205	—	255	ns	Clear to any output
		4.5	—	18	41	—	51		
		6.0	—	—	35	—	43		
$t_{PLH}$	2.0	—	—	205	—	255	ns	Set-to-9 to $Q_A$ , $Q_D$	
	4.5	—	13	41	—	51			
	6.0	—	—	35	—	43			
$t_{PHL}$	2.0	—	—	190	—	240	ns	Set-to-9 to $Q_B$ , $Q_C$	
	4.5	—	17	38	—	48			
	6.0	—	—	32	—	41			
Pulse width	$t_w$	2.0	80	—	—	100	—	ns	
		4.5	16	6	—	20	—		
		6.0	14	—	—	17	—		
Setup time	$t_{su}$	2.0	100	—	—	125	—	ns	
		4.5	20	1	—	25	—		
		6.0	17	—	—	21	—		
Output rise/fall time	$t_{TLH}$	2.0	—	—	75	—	95	ns	
	$t_{THL}$	4.5	—	5	15	—	19		
		6.0	—	—	13	—	16		
Input capacitance	$C_{in}$	—	—	5	10	—	10	pF	

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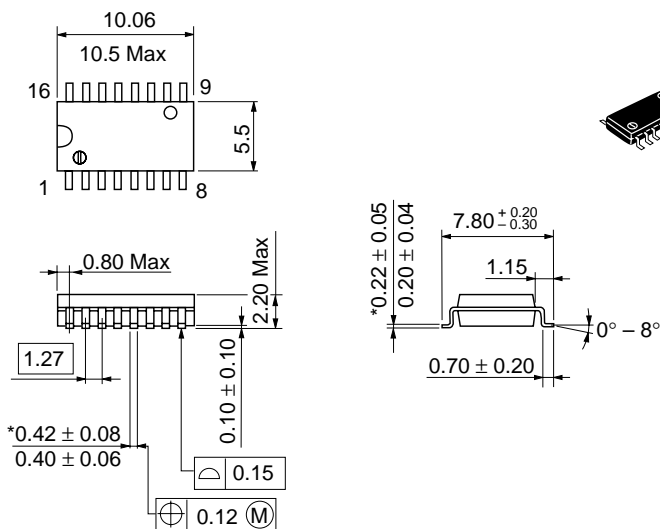
Package Dimensions

Unit: mm



Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	1.07 g

Unit: mm



*0.42 ± 0.08	0.10 ± 0.10	0.15
0.40 ± 0.06		0.12 (M)

Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Mass (reference value)	0.24 g

\*Dimension including the plating thickness  
Base material dimension

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