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# HD74HC590

8-bit Binary Counter/Register (with 3-state outputs)

# HITACHI

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## Description

This device each contains an 8-bit binary counter that feeds an 8-bit storage register. The storage register has parallel outputs. Separate clocks are provided for both the binary counter and storage register. The binary counter features a direct clear input  $\overline{\text{CCLR}}$  and a count enable input  $\overline{\text{CCKEN}}$ . For cascading a ripple carry output  $\overline{\text{RCO}}$  is provided. Expansion is easily accomplished by tying  $\overline{\text{RCO}}$  of the first stage to  $\overline{\text{CCKEN}}$  of the second stage, etc.

Both the counter and register clocks are positive-edge triggered. If the user wishes to connect both clocks together, the counter state will always be one count ahead of the register, Internal circuitry prevents clocking from the clock enable.





## Features

- High Speed Operation:  $t_{pd}$  (RCK to Q) = 18.5 ns typ ( $C_L = 50$  pF)
- High Output Current: Fanout of 15 LSTTL Loads
- Wide Operating Voltage:  $V_{CC} = 2$  to 6 V
- Low Input Current: 1  $\mu\text{A}$  max
- Low Quiescent Supply Current:  $I_{CC}$  (static) = 4  $\mu\text{A}$  max ( $T_a = 25^\circ\text{C}$ )

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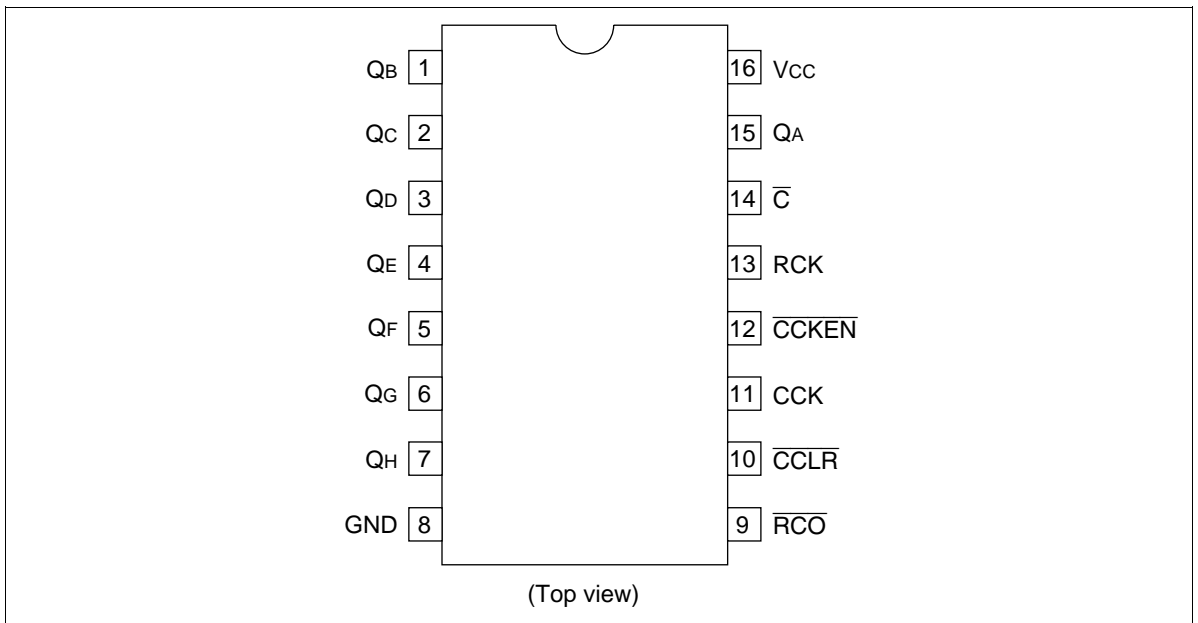
## Function Table

### Inputs

$\overline{G}$	RCK	$\overline{CCLR}$	$\overline{CCKEN}$	CCK	Function
H	X	X	X	X	Q output disabled
L	X	X	X	X	Q output enabled
X		X	X	X	Contents of counter stored to register
X		X	X	X	No change in register
X	X	L	X	X	Counter clear
X	X	H	L		Count up
X	X	H	L		No count
X	X	H	H	X	No count

$$\overline{RCO} = QA' \cdot QB' \cdot QC' \cdot QD' \cdot QE' \cdot QF' \cdot QG' \cdot QH' \cdot (\overline{CCKEN}) \quad (QA' \text{ to } QH': \text{ Output of Internal Counter})$$

## Pin Arrangement



**Absolute Maximum Ratings**

<b>Item</b>	<b>Symbol</b>	<b>Rating</b>	<b>Unit</b>
Supply voltage range	$V_{CC}$	-0.5 to +7.0	V
Input voltage	$V_{IN}$	-0.5 to $V_{CC} + 0.5$	V
Output voltage	$V_{OUT}$	-0.5 to $V_{CC} + 0.5$	V
Output current	$I_{OUT}$	$\pm 35$	mA
DC current drain per $V_{CC}$ , GND	$I_{CC}$ , $I_{GND}$	$\pm 75$	mA
DC input diode current	$I_{IK}$	$\pm 20$	mA
DC output diode current	$I_{OK}$	$\pm 20$	mA
Power Dissipation per package	$P_T$	500	mW
Storage temperature	Tstg	-65 to +150	°C



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	Q <sub>A</sub> to Q <sub>H</sub> V <sub>in</sub> = 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> = -6 mA
		6.0	5.68	—	—	5.63	—				I <sub>OH</sub> = -7.8 mA
	V <sub>OL</sub>	2.0	—	0.0	0.1	—	0.1	V	Q <sub>A</sub> to Q <sub>H</sub> V <sub>in</sub> = 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> = 6 mA
		6.0	—	—	0.26	—	0.33				I <sub>OL</sub> = 7.8 mA
Output voltage	V <sub>OH</sub>	2.0	1.9	2.0	—	1.9	—	V	$\overline{RCO}$ V <sub>in</sub> = 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	$\overline{RCO}$ V <sub>in</sub> = 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
Off-state output current	I <sub>OZ</sub>	6.0	—	—	±0.5	—	±5.0	μA	V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub> , V <sub>out</sub> = V <sub>CC</sub> or GND		
Input current	I <sub>in</sub>	6.0	—	—	±0.1	—	±1.0	μA	V <sub>in</sub> = V <sub>CC</sub> or GND		
Quiescent supply current	I <sub>CC</sub>	6.0	—	—	4.0	—	40	μA	V <sub>in</sub> = V <sub>CC</sub> or GND, I <sub>out</sub> = 0 μA		

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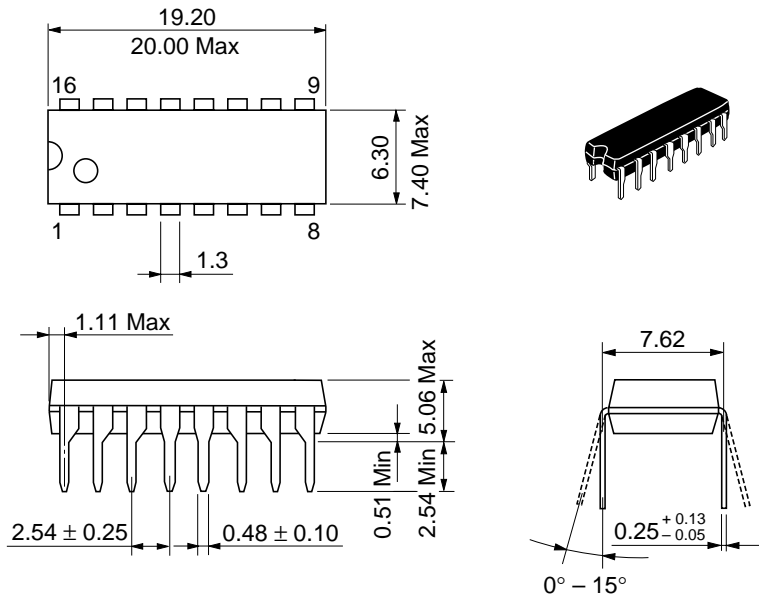
## AC Characteristics ( $C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

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	—	—	5	—	4	MHz	
		4.5	—	—	25	—	20		
		6.0	—	—	29	—	24		
Propagation delay time	$t_{PLH}$	2.0	—	—	200	—	250	ns	$\overline{\text{CCK}}$ to $\overline{\text{RCO}}$
		4.5	—	18	40	—	50		
		6.0	—	—	34	—	43		
	$t_{PLH}$	2.0	—	—	250	—	315	ns	$\overline{\text{CCLR}}$ to $\overline{\text{RCO}}$
		4.5	—	17	50	—	63		
		6.0	—	—	43	—	54		
	$t_{PLH}$	2.0	—	—	200	—	250	ns	RCK to Q
		4.5	—	18	40	—	50		
		6.0	—	—	34	—	43		
Output enable time	$t_{ZL}$	2.0	—	—	150	—	190	ns	
		4.5	—	16	30	—	39		
		6.0	—	—	26	—	33		
Output disable time	$t_{LZ}$	2.0	—	—	150	—	190	ns	
		4.5	—	17	30	—	38		
		6.0	—	—	26	—	33		
Pulse width	$t_w$	2.0	80	—	—	100	—	ns	
		4.5	16	6	—	20	—		
		6.0	14	—	—	17	—		
Removal time	$t_{rem}$	2.0	5	—	—	5	—	ns	$\overline{\text{CCLR}}$ to CCK
		4.5	5	—	—	5	—		
		6.0	5	—	—	5	—		
Setup time	$t_{su}$	2.0	100	—	—	125	—	ns	$\overline{\text{CCKEN}}$ to CCK
		4.5	20	-3	—	25	—		
		6.0	17	—	—	21	—		
	$t_{su}$	2.0	200	—	—	250	—	ns	CCK to RCK
		4.5	40	10	—	50	—		
		6.0	34	—	—	43	—		

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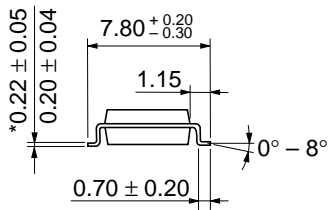
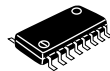
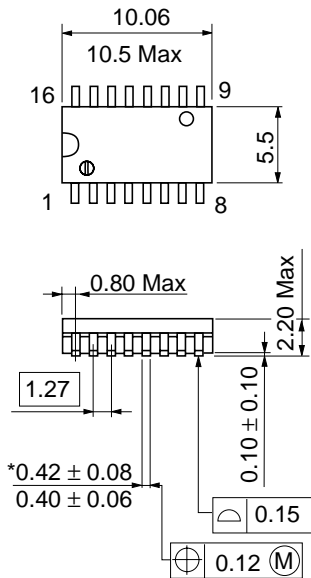
AC Characteristics ( $C_L = 50$  pF, Input  $t_r = t_f = 6$  ns) (cont)

Item	Symbol	$V_{CC}$ (V)	Ta = 25°C		Ta = -40 to +85°C		Unit	Test Conditions	
			Min	Typ	Max	Min			Max
Hold time	$t_h$	2.0	5	—	—	5	—	ns	$\overline{CCKEN}$ to CCK
		4.5	5	—	—	5	—		
		6.0	5	—	—	5	—		
Output rise/fall time	$t_{TLH}$	2.0	—	—	60	—	75	ns	Q
	$t_{THL}$	4.5	—	4	12	—	15		
		6.0	—	—	10	—	13		
	$t_{TLH}$	2.0	—	—	75	—	95	ns	$\overline{RCO}$
	$t_{THL}$	4.5	—	5	15	—	19		
		6.0	—	—	13	—	16		
Input capacitance	$C_{in}$	—	—	5	10	—	10	pF	



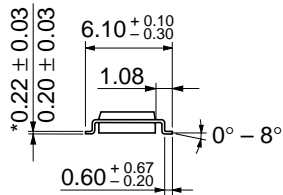
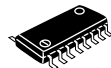
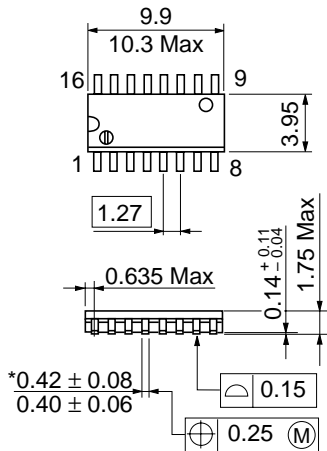
Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g





\*Dimension including the plating thickness  
Base material dimension

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



\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	FP-16DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.15 g

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