
HD74HC590

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

HITACHI

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 μA max
- Low Quiescent Supply Current: I_{CC} (static) = 4 μA max ($T_a = 25^\circ\text{C}$)

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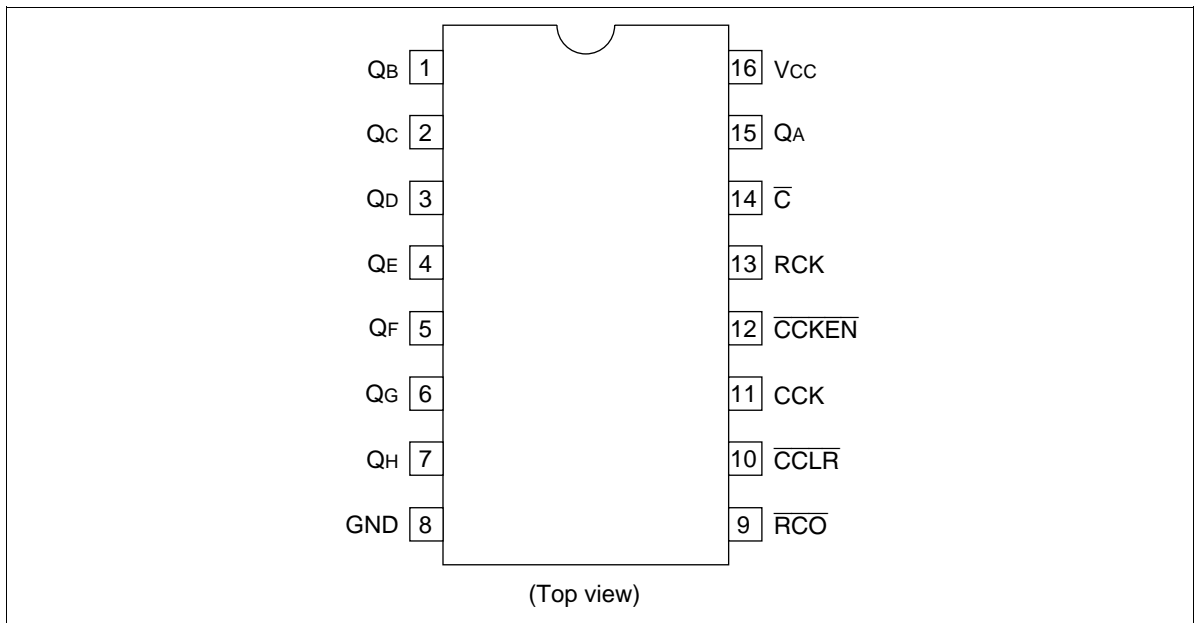
Function Table

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

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

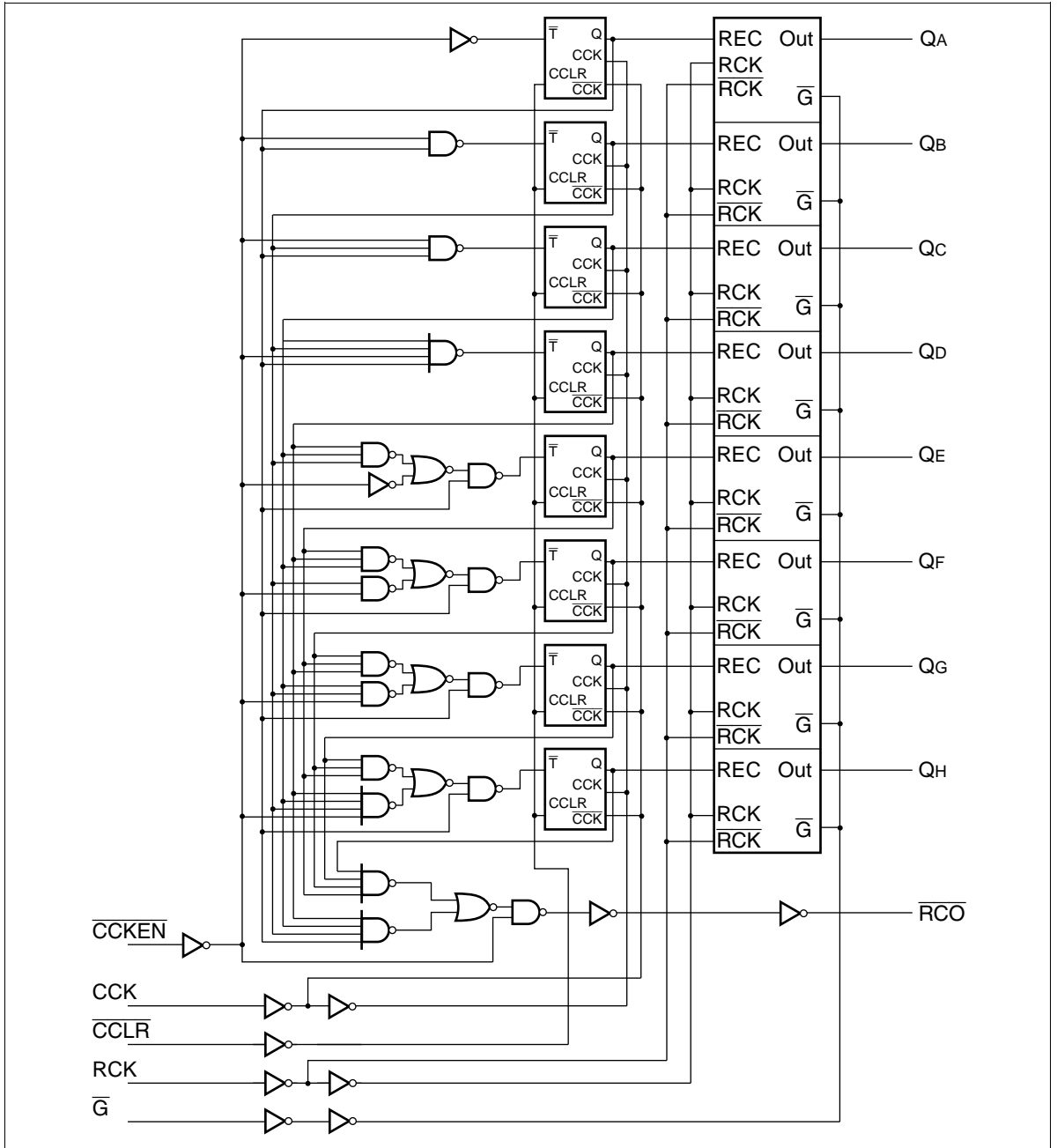
Pin Arrangement



Absolute Maximum Ratings

Item	Symbol	Rating	Unit
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}	± 35	mA
DC current drain per V_{CC} , GND	I_{CC} , I_{GND}	± 75	mA
DC input diode current	I_{IK}	± 20	mA
DC output diode current	I_{OK}	± 20	mA
Power Dissipation per package	P_T	500	mW
Storage temperature	Tstg	-65 to +150	°C

Logic Diagram



DC Characteristics

Item	Symbol	V _{CC} (V)	Ta = 25°C			Ta = -40 to +85°C		Unit	Test Conditions		
			Min	Typ	Max	Min	Max				
Input voltage	V _{IH}	2.0	1.5	—	—	1.5	—	V			
		4.5	3.15	—	—	3.15	—				
		6.0	4.2	—	—	4.2	—				
	V _{IL}	2.0	—	—	0.5	—	0.5	V			
		4.5	—	—	1.35	—	1.35				
		6.0	—	—	1.8	—	1.8				
Output voltage	V _{OH}	2.0	1.9	2.0	—	1.9	—	V	Q _A to Q _H V _{in} = V _{IH} or V _{IL}	I _{OH} = -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 _{OH} = -6 mA
		6.0	5.68	—	—	5.63	—				I _{OH} = -7.8 mA
	V _{OL}	2.0	—	0.0	0.1	—	0.1	V	Q _A to Q _H V _{in} = V _{IH} or V _{IL}	I _{OL} = 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 _{OL} = 6 mA
		6.0	—	—	0.26	—	0.33				I _{OL} = 7.8 mA
Output voltage	V _{OH}	2.0	1.9	2.0	—	1.9	—	V	\overline{RCO} V _{in} = V _{IH} or V _{IL}	I _{OH} = -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 _{OH} = -4 mA
		6.0	5.68	—	—	5.63	—				I _{OH} = -5.2 mA
	V _{OL}	2.0	—	0.0	0.1	—	0.1	V	\overline{RCO} V _{in} = V _{IH} or V _{IL}	I _{OL} = 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 _{OL} = 4 mA
		6.0	—	—	0.26	—	0.33				I _{OL} = 5.2 mA
Off-state output current	I _{OZ}	6.0	—	—	±0.5	—	±5.0	μA	V _{in} = V _{IH} or V _{IL} , V _{out} = V _{CC} or GND		
Input current	I _{in}	6.0	—	—	±0.1	—	±1.0	μA	V _{in} = V _{CC} or GND		
Quiescent supply current	I _{CC}	6.0	—	—	4.0	—	40	μA	V _{in} = V _{CC} or GND, I _{out} = 0 μA		

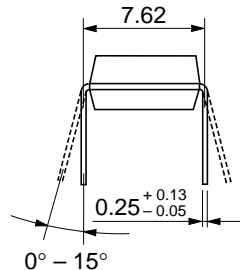
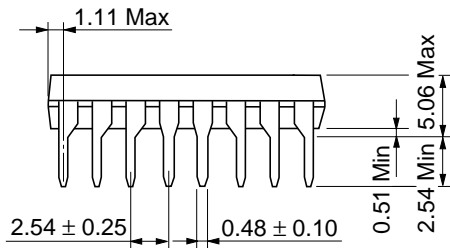
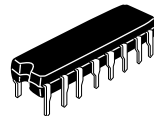
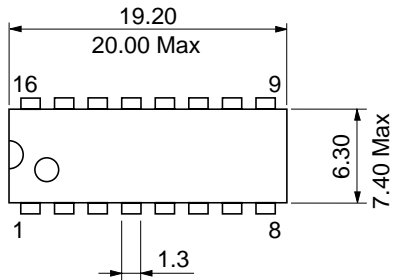
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AC Characteristics ($C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

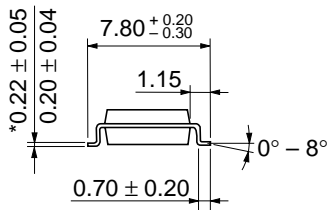
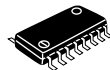
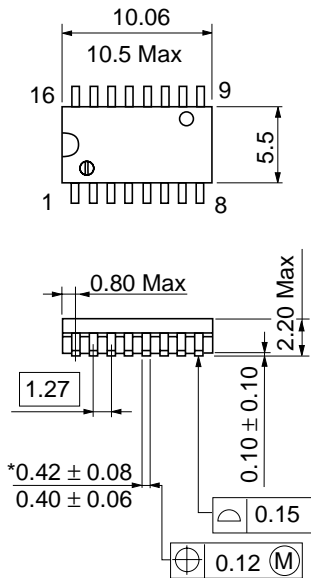
Item	Symbol	V_{CC} (V)	$T_a = 25^\circ\text{C}$			$T_a = -40$ to $+85^\circ\text{C}$		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Maximum clock frequency	f_{max}	2.0	—	—	5	—	4	MHz		
		4.5	—	—	25	—	20			
		6.0	—	—	29	—	24			
Propagation delay time	t_{PLH}	2.0	—	—	200	—	250	ns	$\overline{\text{CCK}}$ 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	—			

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	

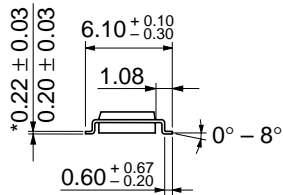
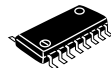
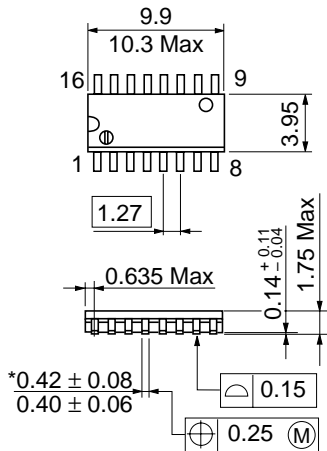


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JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	1.07 g



*Dimension including the plating thickness
Base material dimension

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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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