

To all our customers

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Renesas Technology Corp.  
Customer Support Dept.  
April 1, 2003

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# HD74LV273A

## Octal D-type Flip-Flops with Clear



ADE-205-273A (Z)

2nd Edition  
Aug. 2001

### Description

The HD74LV273A has eight edge trigger D-type flip-flops with clear in a 20-pin package. Data on the D input having the specified setup and hold times is transferred to the Q output on the low to high transition of the clock input. The clear input when low, sets all outputs to a low state. Low-voltage and high-speed operation is suitable for battery-powered products (e.g., notebook computers), and the low-power consumption extends the battery life.

### Features

- $V_{CC} = 2.0\text{ V}$  to  $5.5\text{ V}$  operation
- All inputs  $V_{IH}(\text{Max.}) = 5.5\text{ V}$  ( $@V_{CC} = 0\text{ V}$  to  $5.5\text{ V}$ )
- All outputs  $V_{O}(\text{Max.}) = 5.5\text{ V}$  ( $@V_{CC} = 0\text{ V}$ )
- Typical  $V_{OL}$  ground bounce  $< 0.8\text{ V}$  ( $@V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- Typical  $V_{OH}$  undershoot  $> 2.3\text{ V}$  ( $@V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- Output current  $\pm 6\text{ mA}$  ( $@V_{CC} = 3.0\text{ V}$  to  $3.6\text{ V}$ ),  $\pm 12\text{ mA}$  ( $@V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ )

### Function Table

#### Inputs

$\overline{\text{CLR}}$	CLK	D	Output Q
L	X	X	L
H	$\uparrow$	H	H
H	$\uparrow$	L	L
H	$\downarrow$	X	$Q_0$

Note: H: High level

L: Low level

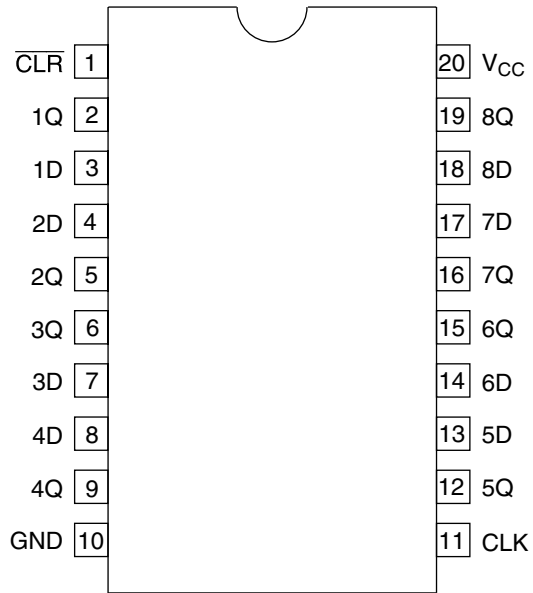
X: Immaterial

$\uparrow$ : Low to high transition

$\downarrow$ : High to low transition

$Q_0$ : Output level before the indicated steady state input conditions were established.

## Pin Arrangement



(Top view)

### Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage range	$V_{CC}$	-0.5 to 7.0	V	
Input voltage range* <sup>1</sup>	$V_I$	-0.5 to 7.0	V	
Output voltage range* <sup>1,2</sup>	$V_O$	-0.5 to $V_{CC} + 0.5$	V	Output: H or L
		-0.5 to 7.0		$V_{CC}$ : OFF
Input clamp current	$I_{IK}$	-20	mA	$V_I < 0$
Output clamp current	$I_{OK}$	±50	mA	$V_O < 0$ or $V_O > V_{CC}$
Continuous output current	$I_O$	±25	mA	$V_O = 0$ to $V_{CC}$
Continuous current through $V_{CC}$ or GND	$I_{CC}$ or $I_{GND}$	±50	mA	
Maximum power dissipation at $T_a = 25^\circ\text{C}$ (in still air)* <sup>3</sup>	$P_T$	835	mW	SOP
		757		TSSOP
Storage temperature	$T_{stg}$	-65 to 150	°C	

Notes: The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

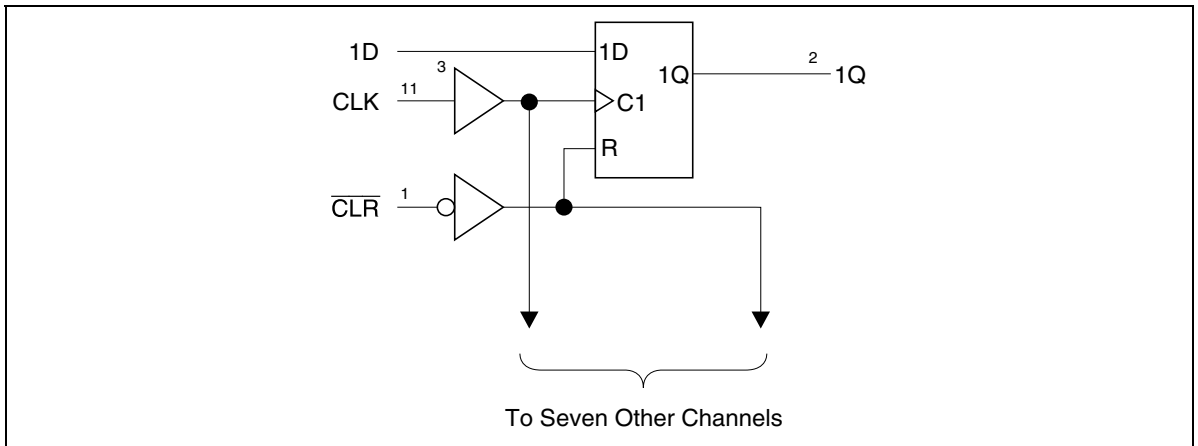
1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of 150°C.

## Recommended Operating Conditions

Item	Symbol	Min	Max	Unit	Conditions
Supply voltage range	$V_{CC}$	2.0	5.5	V	
Input voltage range	$V_I$	0	5.5	V	
Output voltage range	$V_O$	0	$V_{CC}$	V	H or L
Output current	$I_{OH}$	—	-50	$\mu A$	$V_{CC} = 2.0 V$
		—	-2	mA	$V_{CC} = 2.3 \text{ to } 2.7 V$
		—	-6		$V_{CC} = 3.0 \text{ to } 3.6 V$
		—	-12		$V_{CC} = 4.5 \text{ to } 5.5 V$
	$I_{OL}$	—	50	$\mu A$	$V_{CC} = 2.0 V$
		—	2	mA	$V_{CC} = 2.3 \text{ to } 2.7 V$
		—	6		$V_{CC} = 3.0 \text{ to } 3.6 V$
		—	12		$V_{CC} = 4.5 \text{ to } 5.5 V$
Input transition rise or fall rate	$\Delta t / \Delta v$	0	200	ns/V	$V_{CC} = 2.3 \text{ to } 2.7 V$
		0	100		$V_{CC} = 3.0 \text{ to } 3.6 V$
		0	20		$V_{CC} = 4.5 \text{ to } 5.5 V$
Operating free-air temperature	$T_a$	-40	85	$^{\circ}C$	

Note: Unused or floating inputs must be held high or low.

## Logic Diagram



DC Electrical Characteristics

Ta = -40 to 85°C

Item	Symbol	V <sub>cc</sub> (V)*	Min	Typ	Max	Unit	Test Conditions
Input voltage	V <sub>IH</sub>	2.0	1.5	—	—	V	
		2.3 to 2.7	V <sub>cc</sub> × 0.7	—	—		
		3.0 to 3.6	V <sub>cc</sub> × 0.7	—	—		
		4.5 to 5.5	V <sub>cc</sub> × 0.7	—	—		
	V <sub>IL</sub>	2.0	—	—	0.5		
		2.3 to 2.7	—	—	V <sub>cc</sub> × 0.3		
		3.0 to 3.6	—	—	V <sub>cc</sub> × 0.3		
		4.5 to 5.5	—	—	V <sub>cc</sub> × 0.3		
Output voltage	V <sub>OH</sub>	Min to Max	V <sub>cc</sub> - 0.1	—	—	V	I <sub>OH</sub> = -50 μA
		2.3	2.0	—	—		I <sub>OH</sub> = -2 mA
		3.0	2.48	—	—		I <sub>OH</sub> = -6 mA
		4.5	3.8	—	—		I <sub>OH</sub> = -12 mA
	V <sub>OL</sub>	Min to Max	—	—	0.1		I <sub>OL</sub> = 50 μA
		2.3	—	—	0.4		I <sub>OL</sub> = 2 mA
		3.0	—	—	0.44		I <sub>OL</sub> = 6 mA
		4.5	—	—	0.55		I <sub>OL</sub> = 12 mA
Input current	I <sub>IN</sub>	0 to 5.5	—	—	±1	μA	V <sub>I</sub> = 5.5 V or GND
Quiescent supply current	I <sub>CC</sub>	5.5	—	—	20	μA	V <sub>I</sub> = V <sub>cc</sub> or GND, I <sub>o</sub> = 0
Output leakage current	I <sub>OFF</sub>	0	—	—	5	μA	V <sub>I</sub> or V <sub>o</sub> = 0 V to 5.5 V
Input capacitance	C <sub>IN</sub>	3.3	—	2	—	pF	V <sub>I</sub> = V <sub>cc</sub> or GND

Note: For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.

## Switching Characteristics

$$V_{CC} = 2.5 \pm 0.2 \text{ V}$$

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Maximum clock frequency	fmax	55	95	—	45	—	MHz	C <sub>L</sub> = 15 pF		
		45	75	—	40	—				
Propagation delay time	t <sub>PHL</sub>	—	10.3	19.0	1.0	21.0	ns	C <sub>L</sub> = 15 pF	CLR	Q
	t <sub>PLH</sub> / t <sub>PHL</sub>	—	10.4	18.3	1.0	20.5			CLK	Q
	t <sub>PHL</sub>	—	13.1	22.8	1.0	25.5			CLR	Q
	t <sub>PLH</sub> / t <sub>PHL</sub>	—	12.9	22.1	1.0	25.0			CLK	Q
Setup time	t <sub>SU</sub>	8.5	—	—	10.5	—	ns		Data	
		4.0	—	—	4.0	—			CLR inactive	
Hold time	t <sub>H</sub>	0.5	—	—	1.0	—	ns			
Pulse width	t <sub>W</sub>	6.5	—	—	7.0	—	ns		CLR L	
		7.0	—	—	8.5	—			CLK H or L	



Switching Characteristics (cont)

V<sub>CC</sub> = 3.3 ± 0.3 V

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)	
		Min	Typ	Max	Min	Max					
Maximum clock frequency	f <sub>max</sub>	75	140	—	65	—	MHz	C <sub>L</sub> = 15 pF			
		50	110	—	45	—					C <sub>L</sub> = 50 pF
Propagation delay time	t <sub>PHL</sub>	—	6.9	13.6	1.0	16.0	ns	C <sub>L</sub> = 15 pF	CLR	Q	
	t <sub>PLH</sub> / t <sub>PHL</sub>	—	7.1	13.6	1.0	16.0			CLK	Q	
	t <sub>PHL</sub>	—	8.7	17.1	1.0	19.5			C <sub>L</sub> = 50 pF	CLR	Q
	t <sub>PLH</sub> / t <sub>PHL</sub>	—	9.1	17.1	1.0	19.5			CLK	Q	
Setup time	t <sub>SU</sub>	5.5	—	—	6.5	—	ns		Data		
		2.5	—	—	2.5	—			CLR inactive		
Hold time	t <sub>H</sub>	1.0	—	—	1.0	—	ns				
Pulse width	t <sub>W</sub>	5.0	—	—	6.0	—	ns		CLR L		
		5.5	—	—	6.5	—			CLK H or L		

## Switching Characteristics (cont)

$$V_{CC} = 5.0 \pm 0.5 \text{ V}$$

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)	
		Min	Typ	Max	Min	Max					
Maximum clock frequency	fmax	120	205	—	100	—	MHz	C <sub>L</sub> = 15 pF			
		80	160	—	70	—					
Propagation delay time	t <sub>PHL</sub>	—	4.7	8.5	1.0	10.0	ns	C <sub>L</sub> = 15 pF	CLR	Q	
	t <sub>PLH</sub> / t <sub>PHL</sub>	—	4.8	9.0	1.0	10.5			CLK	Q	
	t <sub>PHL</sub>	—	6.0	10.5	1.0	12.0			C <sub>L</sub> = 50 pF	CLR	Q
	t <sub>PLH</sub> / t <sub>PHL</sub>	—	6.2	11.0	1.0	12.5			CLK	Q	
Setup time	t <sub>SU</sub>	4.5	—	—	4.5	—	ns		Data		
		2.0	—	—	2.0	—			CLR inactive		
Hold time	t <sub>H</sub>	1.0	—	—	1.0	—	ns				
Pulse width	t <sub>W</sub>	5.0	—	—	5.0	—	ns		CLR L		
		5.0	—	—	5.0	—			CLK H or L		

### Output-skew Characteristics

Item	Symbol	V <sub>cc</sub> = (V)	Ta = 25°C		Ta = -40 to 85°C		Unit
			Min	Max	Min	Max	
Output skew	t <sub>sk(O)</sub>	2.3 to 2.7	—	2.0	—	2.0	ns
		3.0 to 3.6	—	1.5	—	1.5	
		4.5 to 5.5	—	1.0	—	1.0	

Note: Skew between any outputs of the same package switching in the same direction. This parameter is warranted but not production tested.

### Operating Characteristics

C<sub>L</sub> = 50 pF

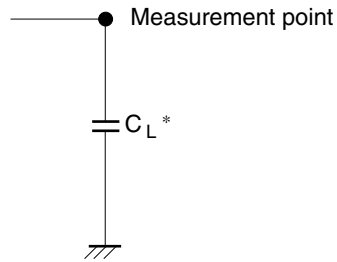
Item	Symbol	V <sub>cc</sub> = (V)	Ta = 25°C			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	C <sub>PD</sub>	3.3	—	15.9	—	pF	f = 10 MHz
		5.0	—	17.1	—		

### Noise Characteristics

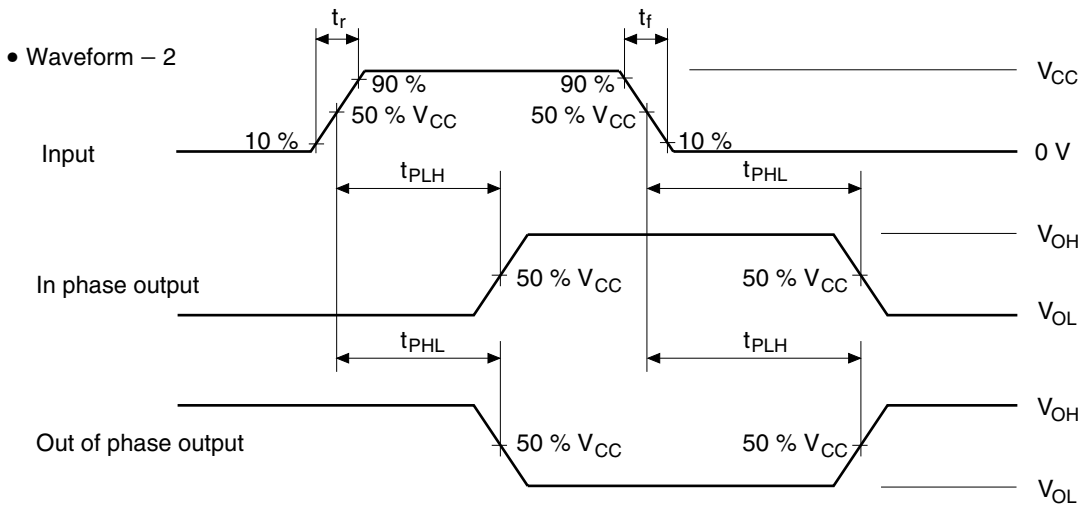
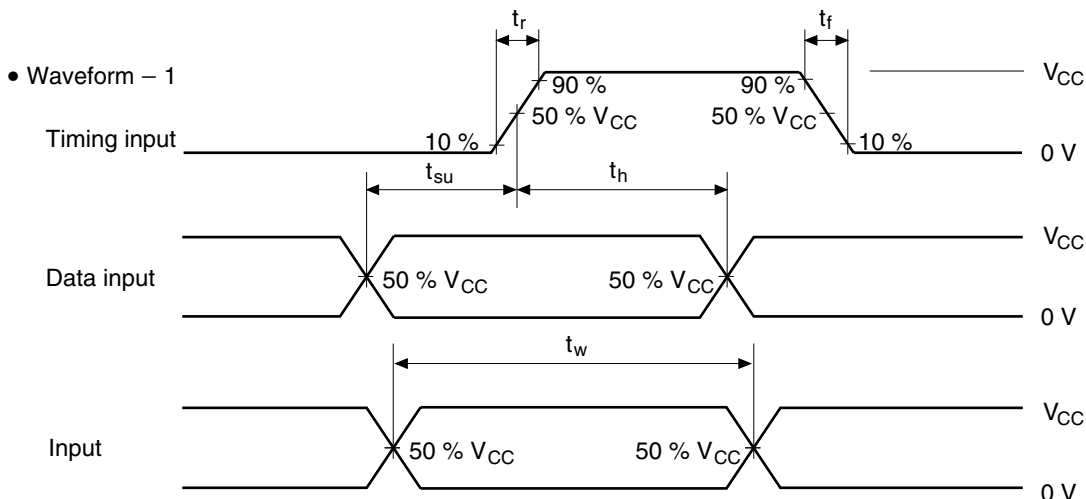
C<sub>L</sub> = 50 pF

Item	Symbol	V <sub>cc</sub> = (V)	Ta = 25°C			Unit	Test Conditions
			Min	Typ	Max		
Quiet output, maximum dynamic V <sub>OL</sub>	V <sub>OL(P)</sub>	3.3	—	0.4	0.8	V	
Quiet output, minimum dynamic V <sub>OL</sub>	V <sub>OL(V)</sub>	3.3	—	-0.4	-0.8		
Quiet output, minimum dynamic V <sub>OH</sub>	V <sub>OH(V)</sub>	3.3	—	2.9	—		
High-level dynamic input voltage	V <sub>IH(D)</sub>	3.3	2.31	—	—	V	
Low-level dynamic input voltage	V <sub>IL(D)</sub>	3.3	—	—	0.99		

## Test Circuit



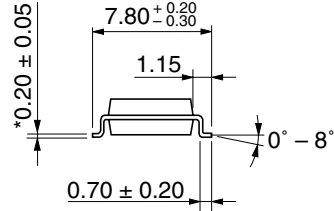
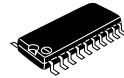
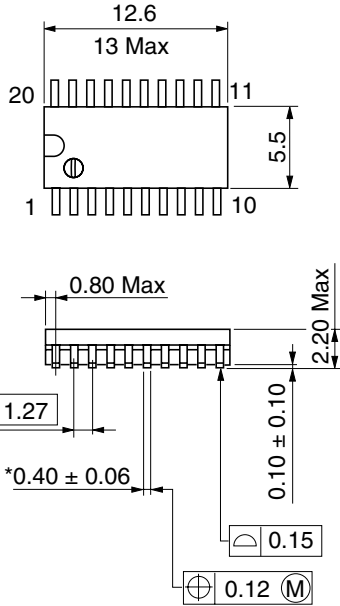
Note:  $C_L$  includes the probe and jig capacitance.



Notes: 1. Input waveform:  $PRR \leq 1 \text{ MHz}$ ,  $Z_o = 50 \Omega$ ,  $t_r \leq 3 \text{ ns}$ ,  $t_f \leq 3 \text{ ns}$   
 2. The output is measured one at a time with one transition per measurement.

## Package Dimensions

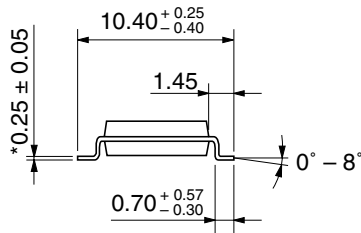
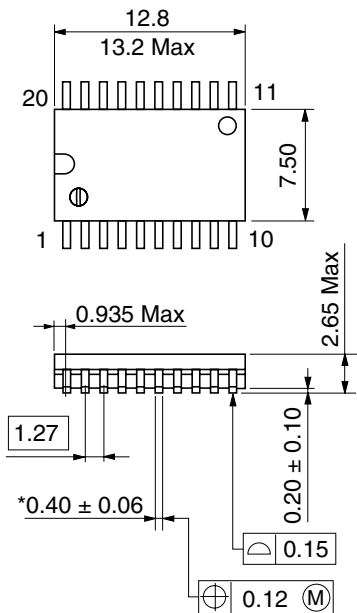
As of July, 2001  
Unit: mm



\*Pd plating

Hitachi Code	FP-20DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.31 g

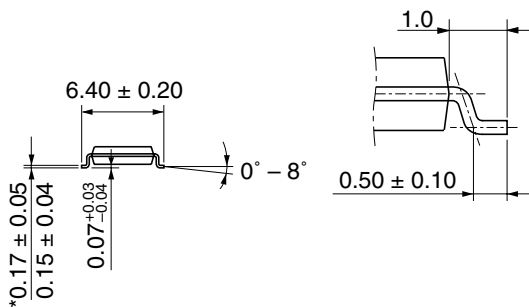
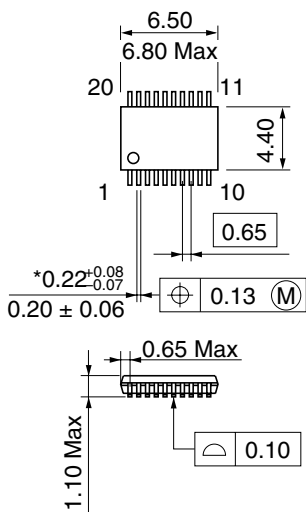
As of July, 2001  
Unit: mm



Hitachi Code	FP-20DBV
JEDEC	Conforms
JEITA	—
Mass (reference value)	0.52 g

\*Pd plating

As of July, 2001  
Unit: mm



Hitachi Code	TTP-20DA
JEDEC	—
JEITA	—
Mass (reference value)	0.07 g

\*Dimension including the plating thickness  
Base material dimension

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