

HD74LV74A

Dual D-type Flip Flops with Preset and Clear

HITACHI

ADE-205-244 (Z)

1st Edition

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Description

The HD74LV74A has independent data, preset, clear, and clock inputs Q and $\overline{Q}$ outputs in a 14 pin package. The input data is transferred to the output at the rising edge of clock pulse CLK. Low-voltage and high-speed operation is suitable for the battery-powered products (e.g., notebook computers), and the low-power consumption extends the battery life.

Features

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

Function Table

Inputs				Outputs	
$\overline{PRE}$	$\overline{CLR}$	CLK	D	Q	$\overline{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H* ¹	H* ¹
H	H	$\uparrow$	H	H	L
H	H	$\uparrow$	L	L	H
H	H	$\downarrow$	X	Q ₀	$\overline{Q}_0$

Note: H:High level

L:Low level

X:Immaterial

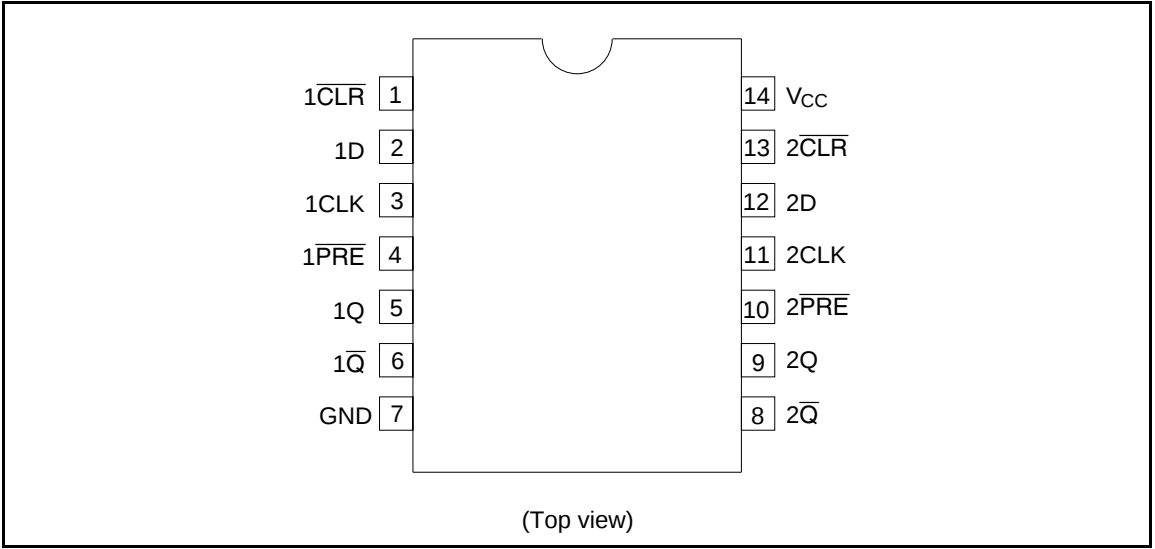
$\uparrow$:Low to high transition

$\downarrow$:High to low transition

Q₀:The level of Q immediately before the input conditions shown in the above table are determined.

1.:Q and $\overline{Q}$ will remain HIGH as long as Preset and Clear are Low, but Q and $\overline{Q}$ are unpredictable, if Preset and Clear go HIGH simultaneously.

Pin Arrangement



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage range	V_{CC}	-0.5 to 7.0	V	
Input voltage range ^{*1}	V_I	-0.5 to 7.0	V	
Output voltage range ^{*1, 2}	V_O	-0.5 to $V_{CC} + 0.5$ -0.5 to 7.0	V	Output: H or L 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) ^{*3}	P_T	785 500	mW	SOP 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.

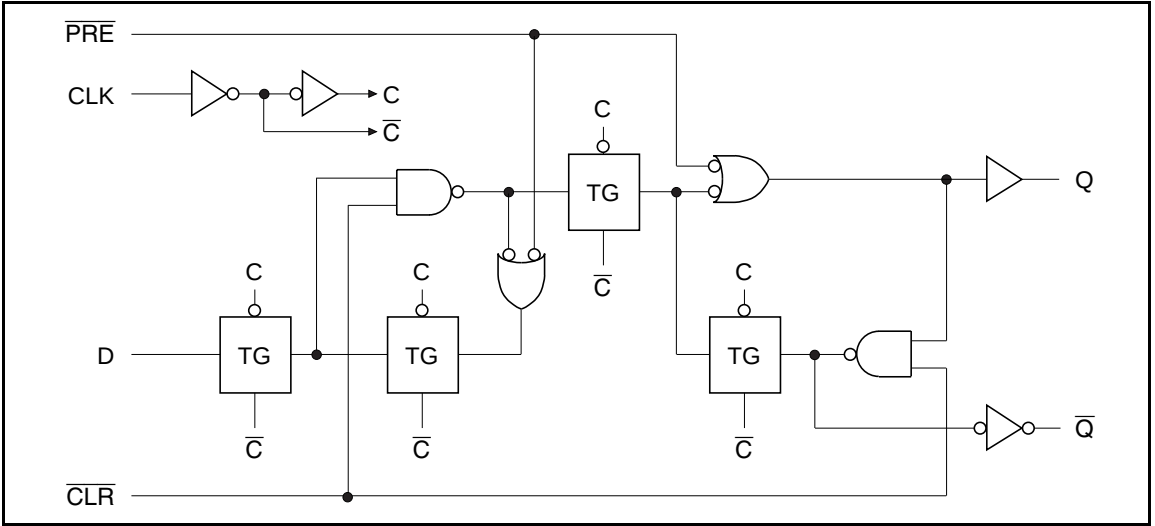
- 1.The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- 2.This value is limited to 5.5 V maximum.
- 3.The maximum package power dissipation was calculated using a junction temperature of 150°C.

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	
Output current	I_{OH}	—	−50	μA	$V_{CC} = 2.0\text{ V}$
		—	−2	mA	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		—	−6		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		—	−12		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
	I_{OL}	—	50	μA	$V_{CC} = 2.0\text{ V}$
		—	2	mA	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		—	6		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		—	12		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
Input transition rise or fall rate	$\Delta t / \Delta v$	0	200	ns/V	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		0	100		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		0	20		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
Operating free-air temperature	T_a	−40	85	°C	

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

Logic Diagram



DC Electrical Characteristics

- $T_a = -40\text{ to }85^\circ\text{C}$
-

Item	Symbol	$V_{CC}\text{ (V)*}$	Min	Typ	Max	Unit	Test Conditions
Input voltage	V_{IH}	2.0	1.5	—	—	V	
		2.3 to 2.7	$V_{CC} \times 0.8$	—	—		
		3.0 to 3.6	$V_{CC} \times 0.8$	—	—		

Item	Symbol	V _{CC} (V)*	Min	Typ	Max	Unit	Test Conditions
	V _{IL}	4.5 to 5.5	V _{CC} × 0.8	—	—		
		2.0	—	—	0.3		
		2.3 to 2.7	—	—	V _{CC} × 0.2		
		3.0 to 3.6	—	—	V _{CC} × 0.2		
		4.5 to 5.5	—	—	V _{CC} × 0.2		
Output voltage	V _{OH}	Min to Max	V _{CC} − 0.1	—	—	V	I _{OL} = −50 μA
		2.3	2.0	—	—		I _{OL} = −2 mA
		3.0	2.48	—	—		I _{OL} = −6 mA
		4.5	3.8	—	—		I _{OL} = −12 mA
	V _{OL}	Min to Max	—	—	0.1	V	I _{OL} = 50 μA
		2.3	—	—	0.4		I _{OL} = 2 mA
		3.0	—	—	0.44		I _{OL} = 6 mA
		4.5	—	—	0.55		I _{OL} = 12 mA
Input current	I _{IN}	0 to 5.5	—	—	±1	μA	V _{IN} = 5.5 V or GND
Quiescent supply current	I _{CC}	5.5	—	—	20	μA	V _{IN} = V _{CC} or GND, I _O = 0
Output leakage current	I _{OFF}	0	—	—	5	μA	V _O = 5.5 V
Input capacitance	C _{IN}	3.3	—	2.0	—	pF	V _I = V _{CC} or GND

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

Switching Characteristics

- V_{CC} = 2.5 ± 0.2 V
-

Ta = 25°C			Ta = −40 to 85°C							
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FROM (In-put)	TO (Out-put)
Maximum clock frequency	t _{max}	50	100	—	40	—	MHz	C _L = 15 pF		
		30	70	—	25	—		C _L = 50 pF		
Propagation delay time	t _{PLH}	—	9.8	14.8	1.0	17.0	ns	C _L = 15 pF	$\overline{\text{PRE}}/\overline{\text{CLR}}$	Q or $\overline{\text{Q}}$
	t _{PHL}	—	11.1	16.4	1.0	19.0			CLK	
		—	13.0	17.4	1.0	20.0		C _L = 50 pF	$\overline{\text{PRE}}/\overline{\text{CLR}}$	Q or $\overline{\text{Q}}$
		—	14.2	20.0	1.0	23.0			CLK	
Setup time	t _{su}	8.0	—	—	9.0	—	ns		Data	
		7.0	—	—	7.0	—			$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ inactive	

		Ta = 25°C			Ta = –40 to 85°C					FROM (In- TO (Out- put) put)
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions		
Hold time	t _h	0.5	—	—	0.5	—	ns			
Pulse width	t _w	8.0	—	—	9.0	—	ns			PRE or CLR “L”
		8.0	—	—	9.0	—				CLK “H” or “L”

Switching Characteristics (cont)

- V_{CC} = 3.3 ± 0.3 V

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		Ta = 25°C			Ta = –40 to 85°C					FRO M (In- TO (Out- put) put)
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions		
Maximum clock frequency	t _{max}	80	140	—	70	—	MHz	C _L = 15 pF		
		50	90	—	45	—		C _L = 50 pF		
Propagation delay time	t _{PLH}	—	6.9	12.3	1.0	14.5	ns	C _L = 15 pF	PRE/ CLR	Q or Q̄
		—	7.9	11.9	1.0	14.0			CLK	—
	t _{PHL}	—	9.2	15.8	1.0	18.0		C _L = 50 pF	PRE/ CLR	Q or Q̄
		—	10.2	15.4	1.0	17.5			CLK	—
Setup time	t _{su}	6.0	—	—	7.0	—	ns		Data	
		5.0	—	—	5.0	—			PRE or CLR inactive	
Hold time	t _h	0.5	—	—	0.5	—	ns			
Pulse width	t _w	6.0	—	—	7.0	—	ns			PRE or CLR “L”
		6.0	—	—	7.0	—				CLK “H” or “L”

Switching Characteristics (cont)

- V_{CC} = 5.0 ± 0.5 V

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		Ta = 25°C			Ta = –40 to 85°C					FRO M (In- TO (Out- put) put)
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions		
Maximum clock frequency	t _{max}	130	180	—	110	—	MHz	C _L = 15 pF		
		90	140	—	75	—		C _L = 50 pF		
Propagation delay time	t _{PLH}	—	5.0	7.7	1.0	9.0	ns	C _L = 15 pF	PRE/ CLR	Q or Q̄
		—	5.6	7.3	1.0	8.5			CLK	—

		Ta = 25°C			Ta = −40 to 85°C				
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FRO M (In- put) TO (Out- put)
Setup time	t _{SU}	—	6.6	9.7	1.0	11.0	ns	C _L = 50 pF	PRE/ CLR
		—	7.2	9.3	1.0	10.5			CLK
		5.0	—	—	5.0	—			Data
		3.0	—	—	3.0	—			PRE or CLR
Hold time	t _H	0.5	—	—	0.5	—	ns		inactive
Pulse width	t _W	5.0	—	—	5.0	—	ns		PRE or CLR “L”
		5.0	—	—	5.0	—			CLK “H” or “L”

Operating Characteristics

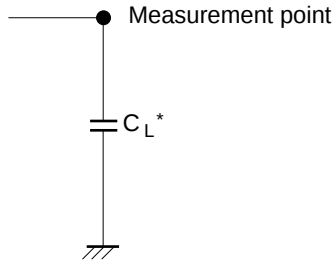
- C_L = 50 pF
-

Ta = 25°C							
Item	Symbol	V _{CC} (V)	Min	Typ	Max	Unit	Test Conditions
Power dissipation capacitance	C _{PD}	3.3	—	21.0	—	pF	f = 10 MHz
		5.0	—	23.0	—		

Noise Characteristics

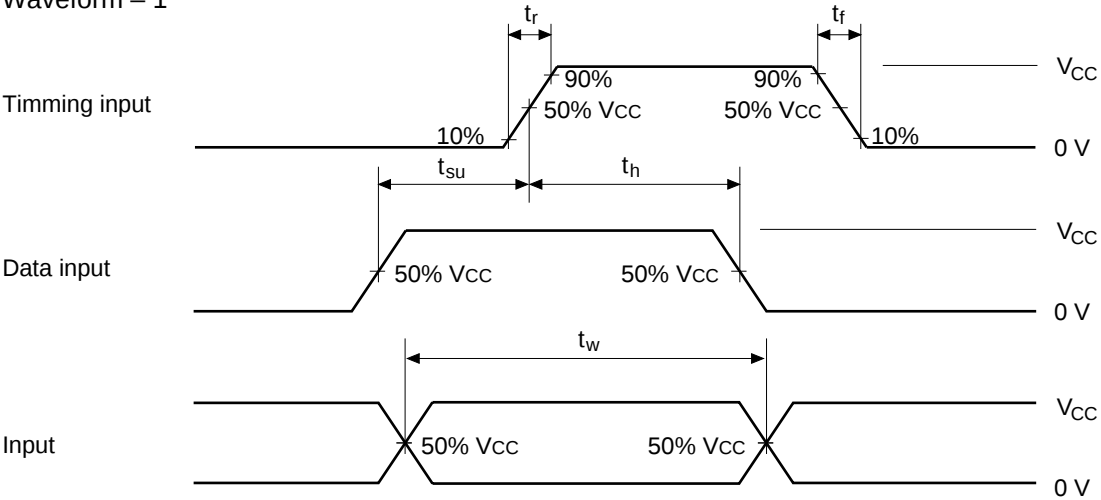
- C_L = 50 pF
-

Ta = 25°C							
Item	Symbol	V _{CC} (V)	Min	Typ	Max	Unit	Test Conditions
Quiet output, maximum dynamic V _{OL}	V _{OL} (P)	3.3	—	0.1	0.8	V	
Quiet output, minimum dynamic V _{OL}	V _{OL} (V)	3.3	—	0	−0.8		
Quiet output, minimum dynamic V _{OH}	V _{OH} (V)	3.3	—	3.2	—		
High-level dynamic input voltage	V _{IH} (D)	3.3	2.31	—	—	V	
Low-level dynamic inout voltage	V _{IL} (D)	3.3	—	—	0.99		

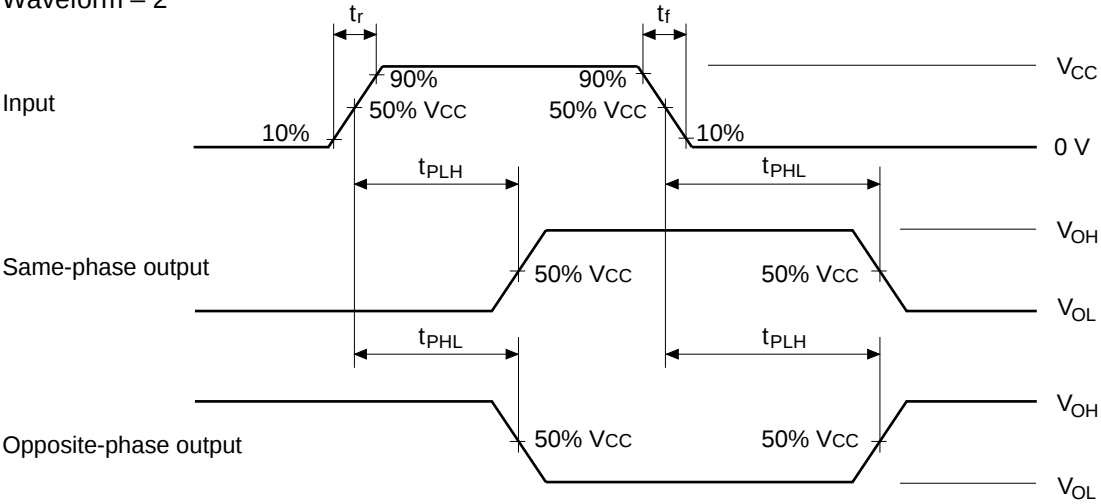
Test Circuit

Note: C_L includes the probe and jig capacitance.

• Waveform – 1



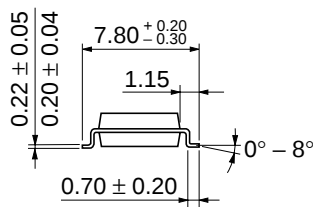
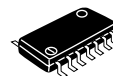
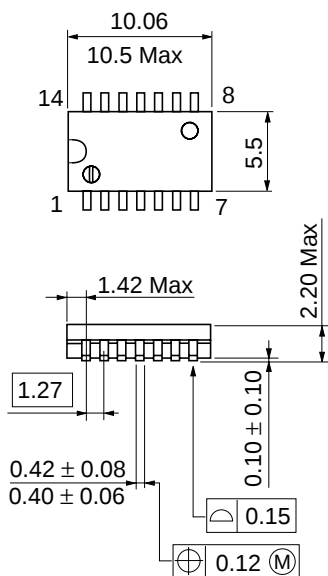
• Waveform – 2



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 are measured one at a time with one transition per measurement.

Package Dimensions

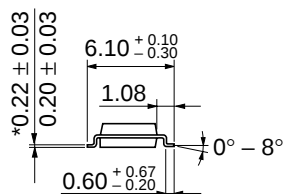
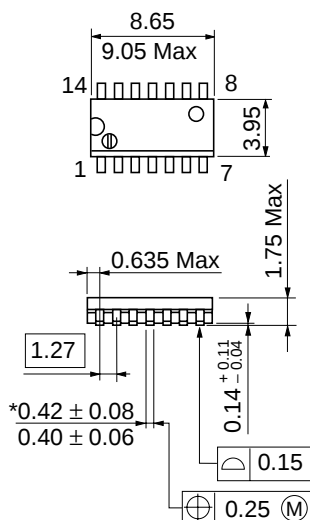
Unit: mm



Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-14DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.23 g

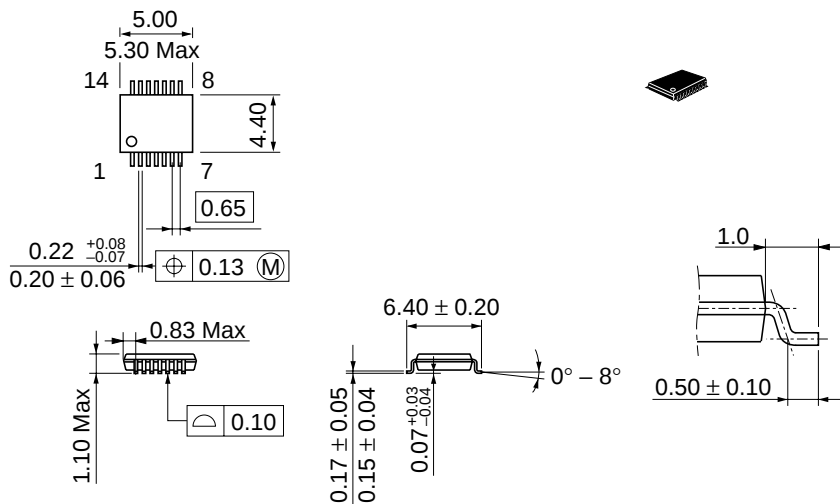
Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-14DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.13 g

Unit: mm



Hitachi Code	TTP-14D
JEDEC	—
EIAJ	—
Weight (reference value)	0.05 g

$$\frac{\text{Dimension including the plating thickness}}{\text{Base material dimension}}$$

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