
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 \bar{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

- $V_{CC} = 2.0\text{ V}$ to 5.5 V operation
- All inputs $V_{IH}(\text{Max.}) = 5.5\text{ V}$ (@ $V_{CC} = 0\text{ V}$ to 5.5 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 V), $\pm 12\text{ mA}$ (@ $V_{CC} = 4.5\text{ V}$ to 5.5 V)

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Function Table

Inputs				Outputs	
PRE	CLR	CLK	D	Q	Q̄
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H* ¹	H* ¹
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	↓	X	Q ₀	Q̄ ₀

Note: H: High level

L: Low level

X: Immaterial

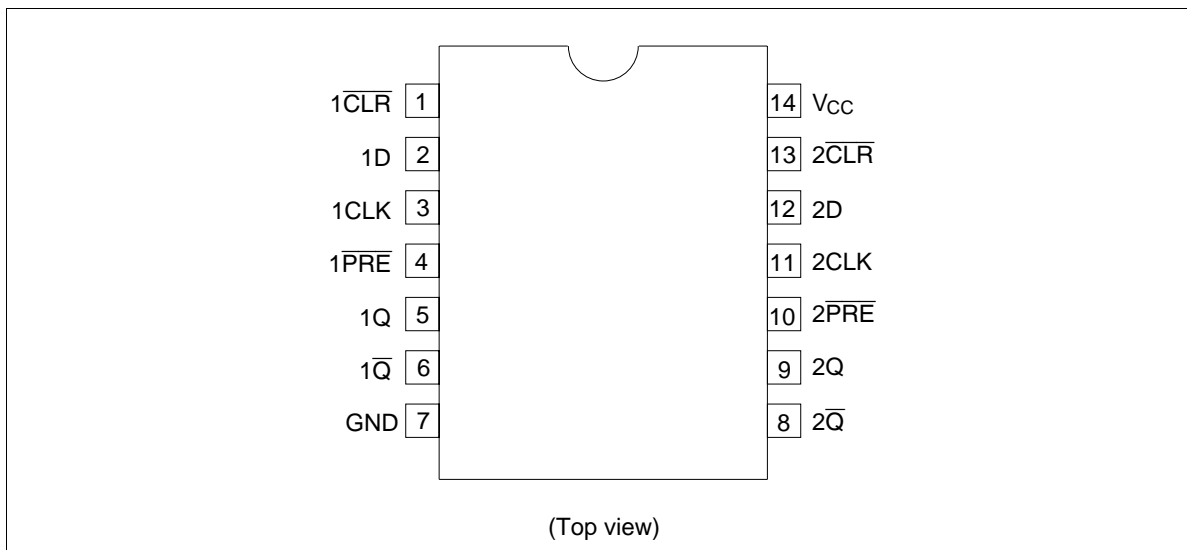
↑: Low to high transition

↓: High to low transition

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

1.: Q and Q̄ will remain HIGH as long as Preset and Clear are Low, but Q and Q̄ are unpredictable, if Preset and Clear go HIGH simultaneously.

Pin Arrangement



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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	$^\circ\text{C}$	

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 $^\circ\text{C}$.

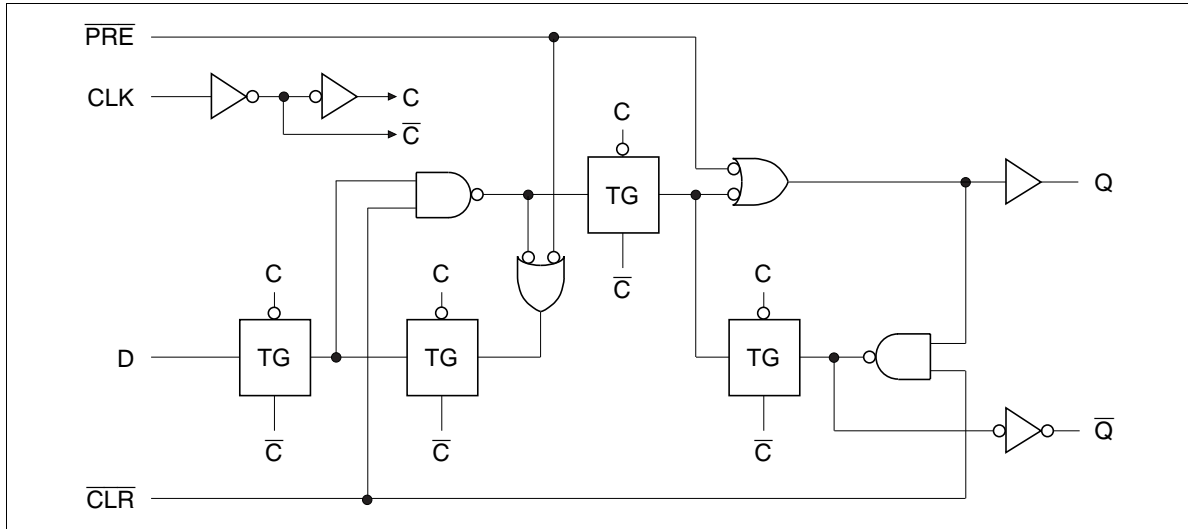
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Recommended Operating Conditions

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	$^{\circ}\text{C}$	

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

Logic Diagram



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DC Electrical Characteristics

- $T_a = -40$ to 85°C

Item	Symbol	V_{CC} (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	$V_{CC} \times 0.8$	—	—			
		4.5 to 5.5	$V_{CC} \times 0.8$	—	—			
	V_{IL}	2.0	—	—	0.3			
		2.3 to 2.7	—	—	$V_{CC} \times 0.2$			
		3.0 to 3.6	—	—	$V_{CC} \times 0.2$			
		4.5 to 5.5	—	—	$V_{CC} \times 0.2$			
Output voltage	V_{OH}	Min to Max	$V_{CC} - 0.1$	—	—	V	$I_{OL} = -50 \mu\text{A}$	
		2.3	2.0	—	—		$I_{OL} = -2 \text{ mA}$	
		3.0	2.48	—	—		$I_{OL} = -6 \text{ mA}$	
		4.5	3.8	—	—		$I_{OL} = -12 \text{ mA}$	
	V_{OL}	Min to Max	—	—	0.1		V	$I_{OL} = 50 \mu\text{A}$
		2.3	—	—	0.4			$I_{OL} = 2 \text{ mA}$
		3.0	—	—	0.44			$I_{OL} = 6 \text{ mA}$
		4.5	—	—	0.55			$I_{OL} = 12 \text{ mA}$
Input current	I_{IN}	0 to 5.5	—	—	± 1	μA		$V_{IN} = 5.5 \text{ V or GND}$
Quiescent supply current	I_{CC}	5.5	—	—	20	μA		$V_{IN} = V_{CC} \text{ or GND, } I_O = 0$
Output leakage current	I_{OFF}	0	—	—	5	μA		$V_O = 5.5 \text{ V}$
Input capacitance	C_{IN}	3.3	—	2.0	—	pF		$V_I = V_{CC} \text{ or GND}$

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

Switching Characteristics

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

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	t_{max}	50	100	—	40	—	MHz	$C_L = 15 pF$		
		30	70	—	25	—				
Propagation delay time	t_{PLH}	—	9.8	14.8	1.0	17.0	ns	$C_L = 15 pF$	$\overline{PRE}/\overline{CLR}$	Q or \overline{Q}
		—	11.1	16.4	1.0	19.0			CLK	
	t_{PHL}	—	13.0	17.4	1.0	20.0	$C_L = 50 pF$	$\overline{PRE}/\overline{CLR}$	Q or \overline{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{PRE} or \overline{CLR} inactive		
Hold time	t_h	0.5	—	—	0.5	—	ns			
Pulse width	t_w	8.0	—	—	9.0	—	ns		\overline{PRE} or \overline{CLR} "L"	
		8.0	—	—	9.0	—		CLK "H" or "L"		

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Switching Characteristics (cont)

- $V_{CC} = 3.3 \pm 0.3 \text{ V}$

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	t_{max}	80	140	—	70	—	MHz	$C_L = 15 \text{ pF}$		
		50	90	—	45	—				
Propagation delay time	t_{PLH}	—	6.9	12.3	1.0	14.5	ns	$C_L = 15 \text{ pF}$	$\overline{PRE}/\overline{CLR}$	Q or \overline{Q}
		—	7.9	11.9	1.0	14.0			CLK	
	t_{PHL}	—	9.2	15.8	1.0	18.0	$C_L = 50 \text{ pF}$	$\overline{PRE}/\overline{CLR}$	Q or \overline{Q}	
		—	10.2	15.4	1.0	17.5		CLK		
Setup time	t_{su}	6.0	—	—	7.0	—	ns		Data	
		5.0	—	—	5.0	—		\overline{PRE} or \overline{CLR} inactive		
Hold time	t_h	0.5	—	—	0.5	—	ns			
Pulse width	t_w	6.0	—	—	7.0	—	ns		\overline{PRE} or \overline{CLR} "L"	
		6.0	—	—	7.0	—		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	t_{max}	130	180	—	110	—	MHz	$C_L = 15 \text{ pF}$		
		90	140	—	75	—				
Propagation delay time	t_{PLH}	—	5.0	7.7	1.0	9.0	ns	$C_L = 15 \text{ pF}$	$\overline{PRE}/\overline{CLR}$	Q or \overline{Q}
		—	5.6	7.3	1.0	8.5			CLK	
	t_{PHL}	—	6.6	9.7	1.0	11.0	$C_L = 50 \text{ pF}$	$\overline{PRE}/\overline{CLR}$	Q or \overline{Q}	
		—	7.2	9.3	1.0	10.5		CLK		
Setup time	t_{su}	5.0	—	—	5.0	—	ns	Data		
		3.0	—	—	3.0	—		\overline{PRE} or \overline{CLR} inactive		
Hold time	t_h	0.5	—	—	0.5	—	ns			
Pulse width	t_w	5.0	—	—	5.0	—	ns	\overline{PRE} or \overline{CLR} "L"		
		5.0	—	—	5.0	—		CLK "H" or "L"		

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Operating Characteristics

- $C_L = 50 \text{ pF}$

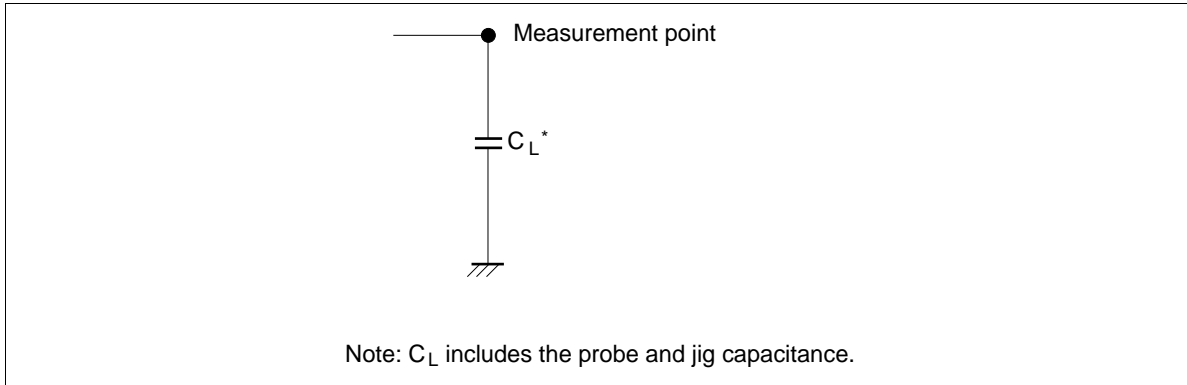
Item	Symbol	V_{CC} (V)	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	C_{PD}	3.3	—	21.0	—	pF	$f = 10 \text{ MHz}$
		5.0	—	23.0	—		

Noise Characteristics

- $C_L = 50 \text{ pF}$

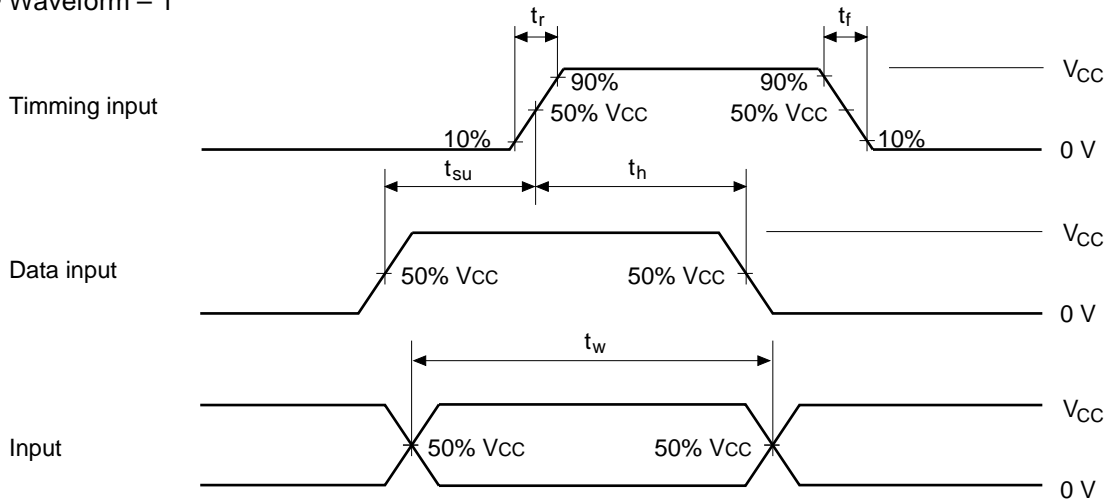
Item	Symbol	V_{CC} (V)	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Quiet output, maximum dynamic V_{OL}	$V_{OL(P)}$	3.3	—	0.1	0.8	V	
Quiet output, minimum dynamic V_{OL}	$V_{OL(V)}$	3.3	—	0	-0.8		
Quiet output, minimum dynamic V_{OH}	$V_{OH(V)}$	3.3	—	3.2	—		
High-level dynamic input voltage	$V_{IH(D)}$	3.3	2.31	—	—	V	
Low-level dynamic input voltage	$V_{IL(D)}$	3.3	—	—	0.99		

Test Circuit

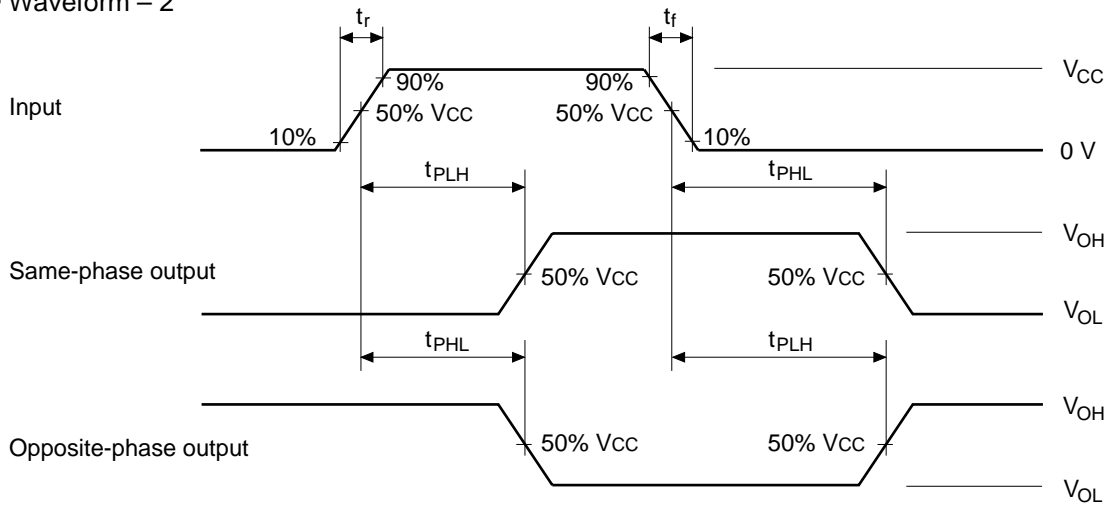


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• Waveform – 1



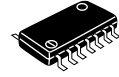
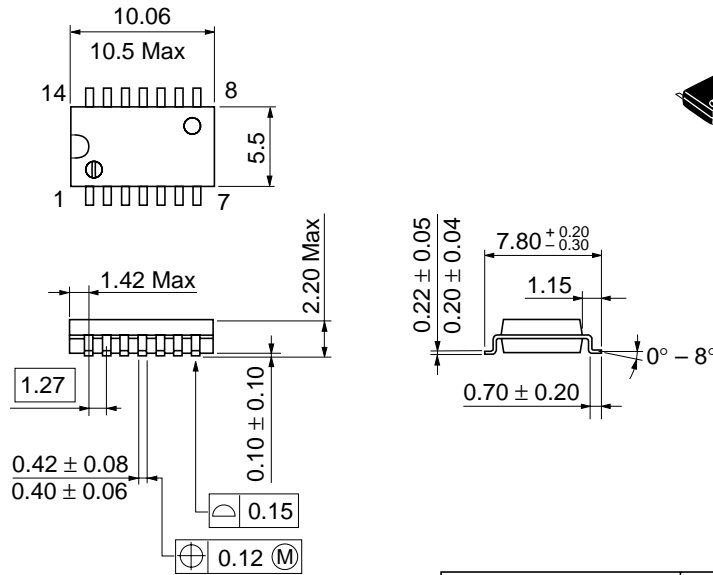
• Waveform – 2



- 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

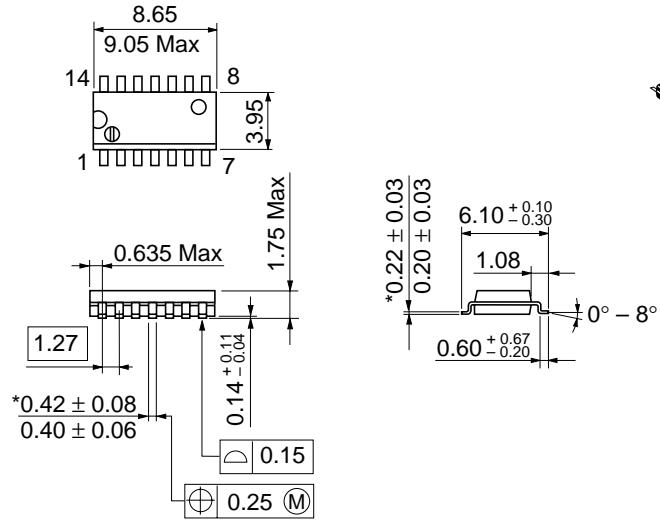


Dimension including the plating thickness
Base material dimension

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

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Unit: mm

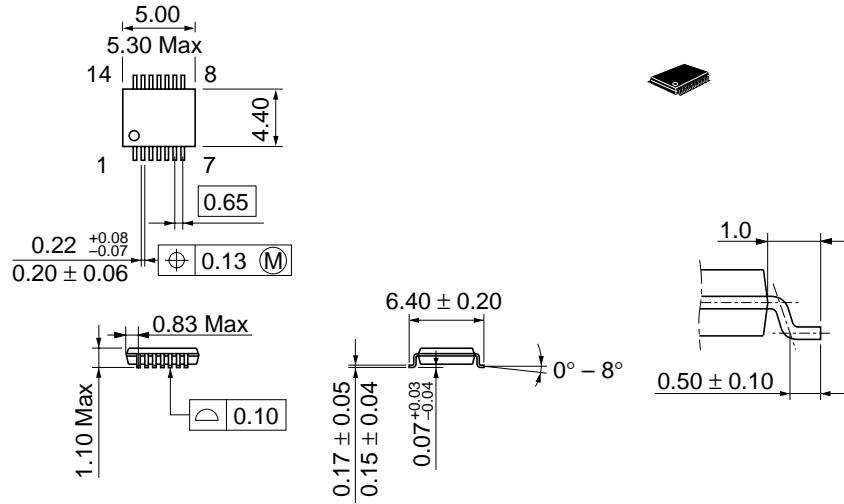


*Dimension including the plating thickness
Base material dimension

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

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Unit: mm



Dimension including the plating thickness
Base material dimension

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

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