HD74LV574A

Octal Edge-Triggered D-type Flip-Flops with 3-state Outputs

HITACHI

ADE-205-280 (Z)
1st Edition
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Description

The HD74LV574A has eight edge-triggered D-type flip-flops with three-state outputs in a 20-pin package. Data at the D inputs meeting set up requirements, are transferred to the Q outputs on positive going transitions of the clock input. When the clock input goes low, data at the D inputs will be retained at the outputs until clock input returns high again. When a high logic level is applied to the output control input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements. 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

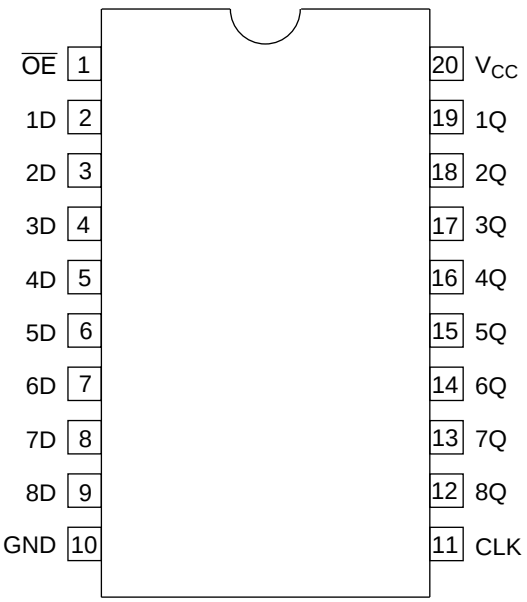
- V_{CC} = 2.0 V to 5.5 V operation
- All inputs V_{IH} (Max.) = 5.5 V (@V_{CC} = 0 V to 5.5 V)
- All outputs V_O (Max.) = 5.5 V (@V_{CC} = 0 V)
- Typical V_{OL} ground bounce < 0.8 V (@V_{CC} = 3.3 V, Ta = 25°C)
- Typical V_{OH} undershoot > 2.3 V (@V_{CC} = 3.3 V, Ta = 25°C)
- Output current ±8 mA (@V_{CC} = 3.0 V to 3.6 V), ±16 mA (@V_{CC} = 4.5 V to 5.5 V)

Function Table

Inputs			
$\overline{OE}$	CLK	D	Output Q
L	↑	H	H
L	↑	L	L
L	↓	X	Q_0
H	X	X	Z

Note: H: High level
L: Low level
X: Immaterial
Z: High impedance
↑: Low to high transition
↓: 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*[1]	V_I	–0.5 to 7.0	V	
Output voltage range*[1, 2]	V_O	–0.5 to V_{CC} + 0.5	V	Output: H or L
		–0.5 to 7.0		V_{CC}: Z or 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	±35	mA	V_O = 0 to V_{CC}
Continuous current through V_{CC} or GND	I_{CC} or I_{GND}	±70	mA	
Maximum power dissipation at Ta = 25°C (in still air)*[3]	P_T	835	mW	SOP
		757		TSSOP
Storage temperature	Tstg	–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.

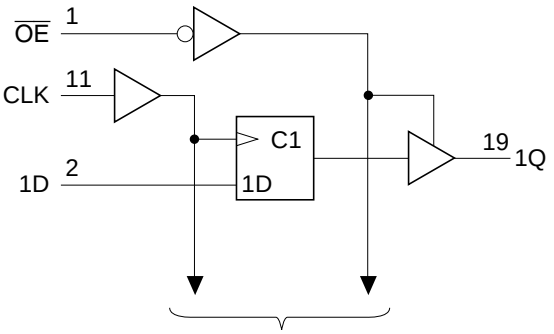
1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of 150°C.

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
		0	5.5		Output: Z
Output current	I_{OH}	—	–50	µA	V_{CC} = 2.0 V
		—	–2	mA	V_{CC} = 2.3 to 2.7 V
		—	–8		V_{CC} = 3.0 to 3.6 V
		—	–16		V_{CC} = 4.5 to 5.5 V
	I_{OL}	—	50	µA	V_{CC} = 2.0 V
		—	2	mA	V_{CC} = 2.3 to 2.7 V
		—	8		V_{CC} = 3.0 to 3.6 V
		—	16		V_{CC} = 4.5 to 5.5 V
Input transition rise or fall rate	Δt/Δv	0	200	ns/V	V_{CC} = 2.3 to 2.7 V
		0	100		V_{CC} = 3.0 to 3.6 V
		0	20		V_{CC} = 4.5 to 5.5 V
Operating free-air temperature	Ta	–40	85	°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_{CC} (V)*	Min	Typ	Max	Unit	Test Conditions
Input voltage	V_{IH}	2.0	1.5	—	—	V	
		2.3 to 2.7	$V_{CC} \times 0.7$	—	—		
		3.0 to 3.6	$V_{CC} \times 0.7$	—	—		
		4.5 to 5.5	$V_{CC} \times 0.7$	—	—		
	V_{IL}	2.0	—	—	0.5		
		2.3 to 2.7	—	—	$V_{CC} \times 0.3$		
		3.0 to 3.6	—	—	$V_{CC} \times 0.3$		
		4.5 to 5.5	—	—	$V_{CC} \times 0.3$		
Output voltage	V_{OH}	Min to Max	V_{CC} – 0.1	—	—	V	I_{OH} = –50 µA
		2.3	2.0	—	—		I_{OH} = –2 mA
		3.0	2.48	—	—		I_{OH} = –8 mA
		4.5	3.8	—	—		I_{OH} = –16 mA
	V_{OL}	Min to Max	—	—	0.1		I_{OL} = 50 µA
		2.3	—	—	0.4		I_{OL} = 2 mA
		3.0	—	—	0.44		I_{OL} = 8 mA
		4.5	—	—	0.55		I_{OL} = 16 mA
Input current	I_{IN}	0 to 5.5	—	—	±1	µA	V_I = 5.5 V or GND
Off-state output current	I_{OZ}	5.5	—	—	±5	µA	$V_O = V_{CC}$ or GND
Quiescent supply current	I_{CC}	5.5	—	—	20	µA	$V_I = V_{CC}$ or GND, I_O = 0
Output leakage current	I_{OFF}	0	—	—	5	µA	V_I or V_O = 0 V to 5.5 V
Input capacitance	C_{IN}	3.3	—	1.8	—	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 (Input)**	**TO (Output)**
Maximum clock frequency	fmax	60	100	—	50	—	MHz	C_L = 15 pF		
		50	85	—	40	—		C_L = 50 pF		
Propa-gation delay time	t_{PLH} t_{PHL}	—	9.6	16.6	1.0	20.0	ns	C_L = 15 pF	CLK	Q
		—	11.6	19.6	1.0	23.0		C_L = 50 pF		
Enable time	t_{ZH} t_{ZL}	—	9.2	16.1	1.0	19.0	ns	C_L = 15 pF	$\overline{OE}$	Q
		—	10.9	19.0	1.0	22.0		C_L = 50 pF		
Disable time	t_{HZ} t_{LZ}	—	6.5	12.8	1.0	15.0	ns	C_L = 15 pF	$\overline{OE}$	Q
		—	8.4	17.5	1.0	20.0		C_L = 50 pF		
Setup time	t_{su}	5.5	—	—	5.5	—	ns		Data before CLK ↑	
Hold time	t_h	2.0	—	—	2.0	—	ns		Data after CLK ↑	
Pulse width	t_w	7.0	—	—	7.0	—	ns		CLK: H or L	

Switching Characteristics (cont)

- **V_{CC} = 3.3 ± 0.3 V**

		Ta = 25°C			Ta = –40 to 85°C					
Item	**Symbol**	**Min**	**Typ**	**Max**	**Min**	**Max**	**Unit**	**Test Conditions**	**FROM (Input)**	**TO (Output)**
Maximum clock frequency	fmax	80	145	—	65	—	MHz	C_L = 15 pF		
		55	120	—	45	—		C_L = 50 pF		
Propa-gation delay time	t_{PLH} t_{PHL}	—	6.8	13.2	1.0	15.5	ns	C_L = 15 pF	CLK	Q
		—	8.1	16.7	1.0	19.0		C_L = 50 pF		
Enable time	t_{ZH} t_{ZL}	—	6.4	12.8	1.0	15.0	ns	C_L = 15 pF	$\overline{OE}$	Q
		—	7.7	16.3	1.0	18.5		C_L = 50 pF		
Disable time	t_{HZ} t_{LZ}	—	4.8	13.0	1.0	15.0	ns	C_L = 15 pF	$\overline{OE}$	Q
		—	6.1	15.0	1.0	17.0		C_L = 50 pF		
Setup time	t_{su}	3.5	—	—	3.5	—	ns		Data before CLK ↑	
Hold time	t_h	1.5	—	—	1.5	—	ns		Data after CLK ↑	
Pulse width	t_w	5.0	—	—	5.0	—	ns		CLK: H or L	

Switching Characteristics (cont)

- V_{CC} = 5.0 ± 0.5 V

		Ta = 25°C			Ta = –40 to 85°C					
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Maximum clock frequency	fmax	130	205	—	110	—	MHz	C_L = 15 pF		
		85	175	—	75	—		C_L = 50 pF		
Propa-gation delay time	t_{PLH} t_{PHL}	—	4.8	8.6	1.0	10.0	ns	C_L = 15 pF	CLK	Q
		—	5.7	10.6	1.0	12.0		C_L = 50 pF		
Enable time	t_{ZH} t_{ZL}	—	4.6	9.0	1.0	10.5	ns	C_L = 15 pF	$\overline{OE}$	Q
		—	5.5	11.0	1.0	12.5		C_L = 50 pF		
Disable time	t_{HZ} t_{LZ}	—	3.5	9.0	1.0	10.5	ns	C_L = 15 pF	$\overline{OE}$	Q
		—	4.1	10.1	1.0	11.5		C_L = 50 pF		
Setup time	t_{su}	3.5	—	—	3.5	—	ns		Data before CLK ↑	
Hold time	t_h	1.5	—	—	1.5	—	ns		Data after CLK ↑	
Pulse width	t_w	5.0	—	—	5.0	—	ns		CLK: H or L	

Output-skew Characteristics

			Ta = 25°C			Ta = –40 to 85°C		
Item	Symbol	V_{cc} (V)	Min	Typ	Max	Min	Max	Unit
Output skew	$t_{sk\ (O)}$	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_L = 50 pF**

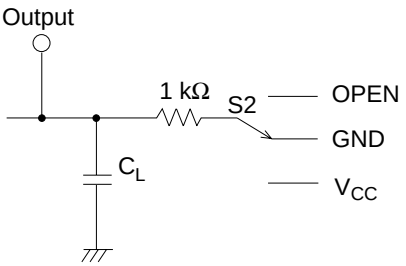
			Ta = 25°C				
Item	**Symbol**	**V_{cc} (V)**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions**
Power dissipation capacitance	C_{PD}	3.3	—	20.4	—	pF	f = 10 MHz
		5.0	—	23.8	—		

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	—	0.7	0.8	V	
Quiet output, minimum dynamic V_{OL}	$V_{OL (V)}$	3.3	—	–0.6	–0.8		
Quiet output, minimum dynamic V_{OH}	$V_{OH (V)}$	3.3	—	2.8	—		
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		

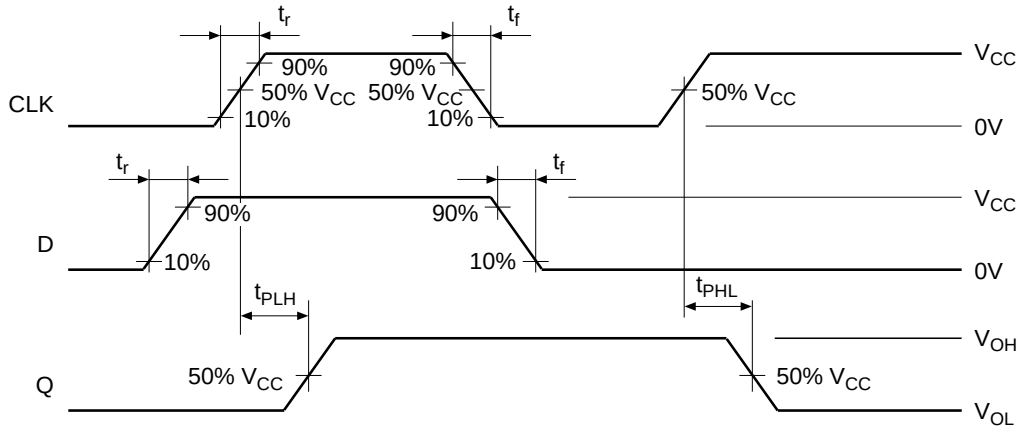
Test Circuit



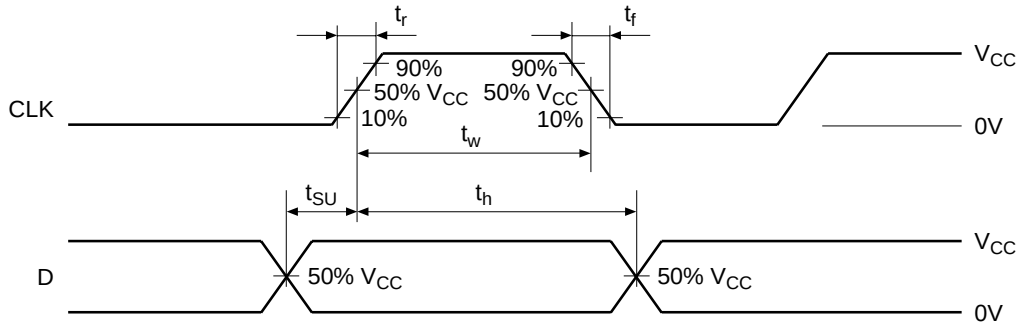
TEST	S2
t_{PLH}/t_{PHL}	OPEN
t_{ZH}/t_{HZ}	GND
t_{ZL}/t_{LZ}	V_{CC}

Note: C_L includes the probe and jig capacitance.

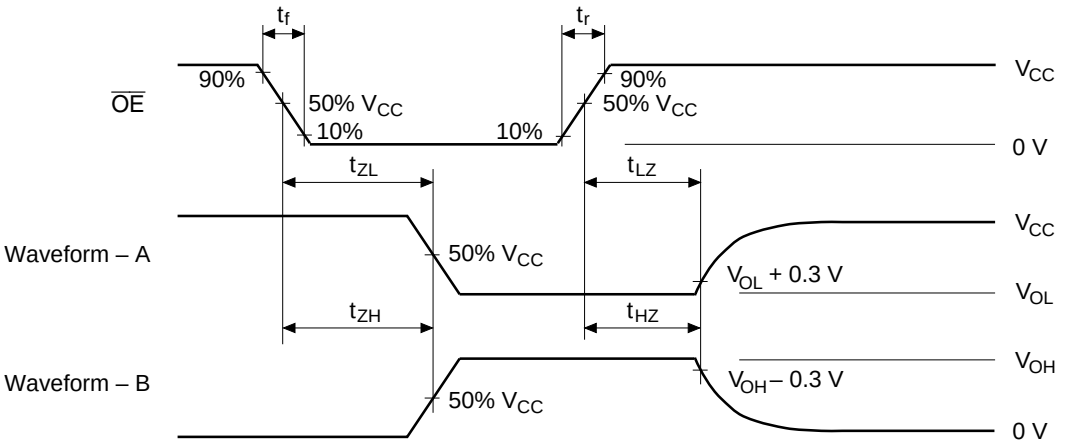
• Waveform – 1



• Waveform – 2

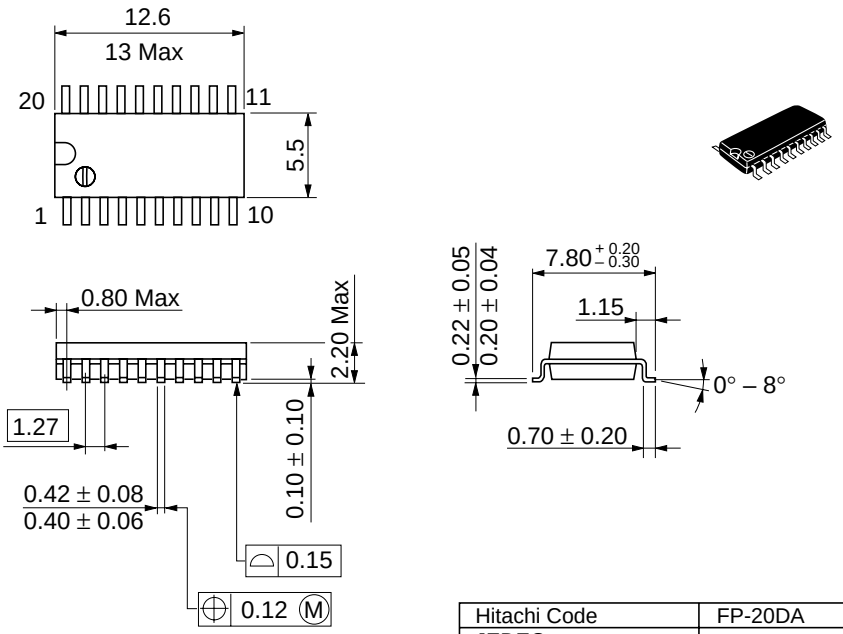


• Waveform – 3



Notes: 1. Input waveform: PRR ≤ 1 MHz, Zo = 50 Ω, t_r ≤ 3 ns, t_f ≤ 3 ns
2. Waveform-A is for an output with internal conditions such that the output is low except when disabled by the output control.
3. Waveform-B is for an output with internal conditions such that the output is high except when disabled by the output control.
4. The output is measured one at a time with one transition per measurement.

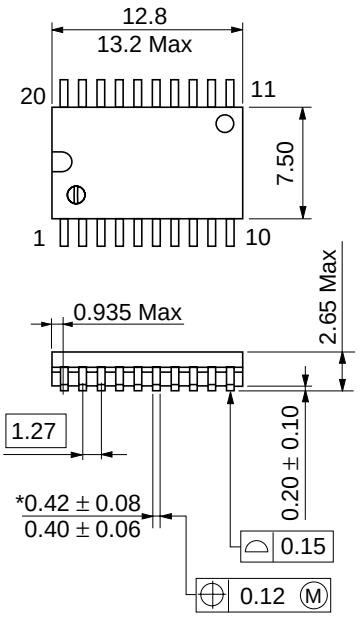
Package Dimensions

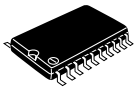


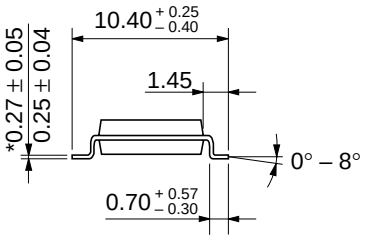
Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-20DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.31 g

Unit: mm

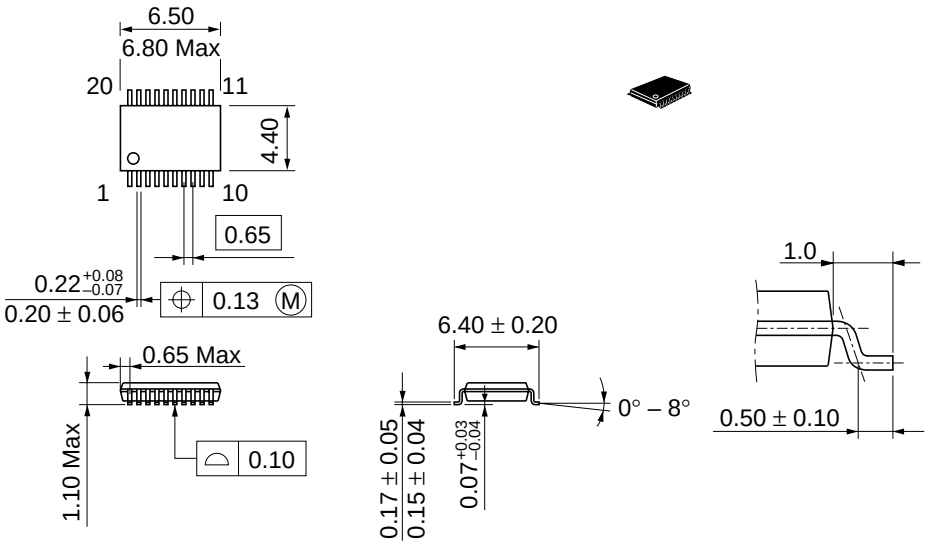






*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-20DB
JEDEC	Conforms
EIAJ	—
Weight (reference value)	0.52 g



Dimension including the plating thickness
Base material dimension

Hitachi Code	TTP-20DA
JEDEC	—
EIAJ	—
Weight (reference value)	0.07 g

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