

# HD74LV240A

Octal Buffers / Drivers with 3-state Outputs

# HITACHI

ADE-205-272 (Z)

1st Edition

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## Description

The HD74V240A has eight inverter drivers with three-state outputs in a 20-pin package. Four inverters are included in one circuit. Each circuit can be independently controlled by the enable signal  $\overline{1OE}$  or  $\overline{2OE}$ , which enables outputs when receiving a low-level signal. Low-voltage 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  $V_{IH}$  (Max.) =  $5.5\text{ V}$  (@  $V_{CC} = 0\text{ V}$  to  $5.5\text{ V}$ )
- All outputs  $V_O$  (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  $\pm 8\text{ mA}$  (@  $V_{CC} = 3.0\text{ V}$  to  $3.6\text{ V}$ ),  $\pm 16\text{ mA}$  (@  $V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ )

## Function Table

### Inputs

$\overline{OE}$	A	Output Y
L	H	L
L	L	H
H	X	Z

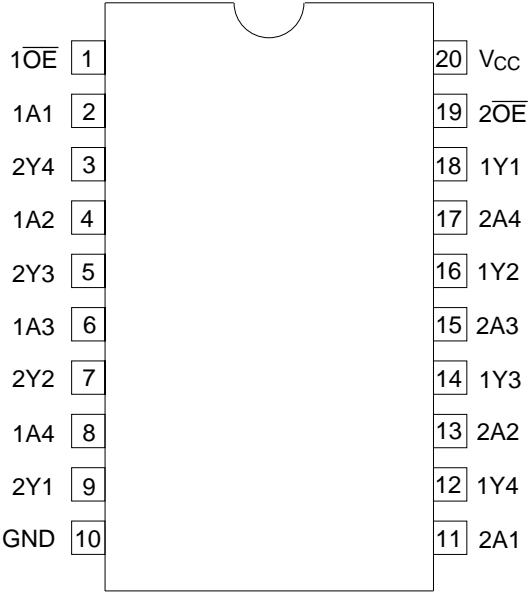
Note: H: High level

L: Low level

X: Immaterial

Z: High impedance

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 $V_{CC} + 0.5$ −0.5 to 7.0	V	Output: H or L $V_{CC}$ : OFF or Output: Z
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 $T_a = 25^{\circ}\text{C}$ (in still air)* <sup>3</sup>	$P_T$	835  757	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.

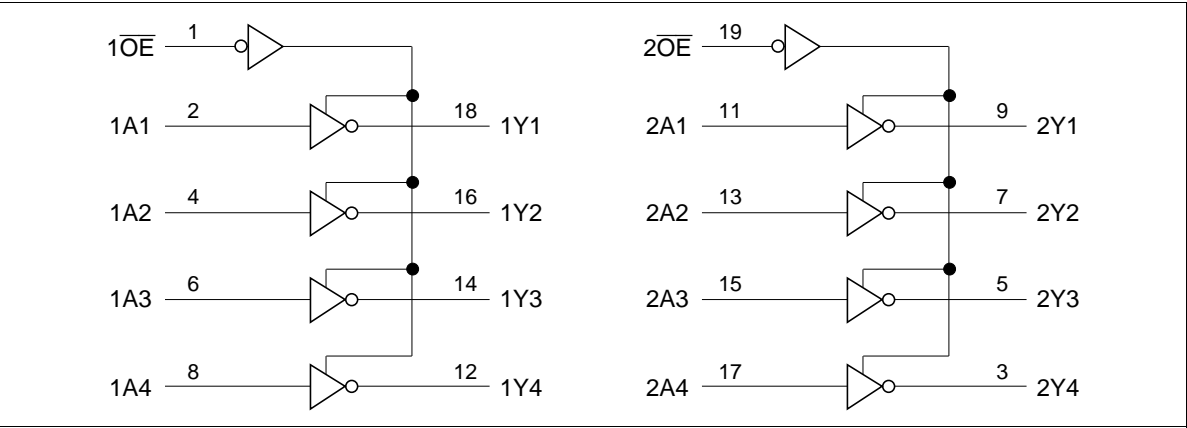
1. The input and output voltage ratings may be exceeded even if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of 150°C.

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		High impedance state
Output current	$I_{OH}$	—	−50	$\mu A$	$V_{CC} = 2.0\text{ V}$
		—	−2	mA	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		—	−8		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		—	−12		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
	$I_{OL}$	—	50	$\mu A$	$V_{CC} = 2.0\text{ V}$
		—	2	mA	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		—	8		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		—	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	$^{\circ}C$	

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

Logic Diagram



## DC Electrical Characteristics

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

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	$I_{OH} = -50\ \mu\text{A}$
		2.3	2.0	—	—		$I_{OH} = -2\ \text{mA}$
		3.0	2.48	—	—		$I_{OH} = -8\ \text{mA}$
		4.5	3.8	—	—		$I_{OH} = -16\ \text{mA}$
	$V_{OL}$	Min to Max	—	—	0.1		$I_{OL} = 50\ \mu\text{A}$
		2.3	—	—	0.4		$I_{OL} = 2\ \text{mA}$
		3.0	—	—	0.44		$I_{OL} = 8\ \text{mA}$
		4.5	—	—	0.55		$I_{OL} = 16\ \text{mA}$
Input current	$I_{IN}$	0 to 5.5	—	—	$\pm 1$	$\mu\text{A}$	$V_{IN} = 5.5\ \text{V}$ or GND
Off-state output current	$I_{OZ}$	5.5	—	—	$\pm 5$	$\mu\text{A}$	$V_O = V_{CC}$ or GND
Quiescent supply current	$I_{CC}$	5.5	—	—	20	$\mu\text{A}$	$V_{IN} = V_{CC}$ or GND, $I_O = 0$
Output leakage current	$I_{OFF}$	0	—	—	5	$\mu\text{A}$	$V_O = 5.5\ \text{V}$
Input capacitance	$C_{IN}$	3.3	—	2.3	—	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

•  $V_{CC} = 2.5 \pm 0.2\text{ V}$

Item	Symbol	Ta = 25°C			Ta = −40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	$t_{PLH}$ $t_{PHL}$	—	6.3	11.6	1.0	14.0	ns	$C_L = 15\text{ pF}$	A	Y
		—	8.2	14.4	1.0	17.0		$C_L = 50\text{ pF}$		
Enable time	$t_{ZH}$ $t_{ZL}$	—	8.5	14.6	1.0	17.0	ns	$C_L = 15\text{ pF}$	$\overline{OE}$	Y
		—	10.3	17.8	1.0	21.0		$C_L = 50\text{ pF}$		
Disable time	$t_{HZ}$ $t_{LZ}$	—	9.7	14.1	1.0	16.0	ns	$C_L = 15\text{ pF}$	$\overline{OE}$	Y
		—	14.2	19.2	1.0	21.0		$C_L = 50\text{ pF}$		

•  $V_{CC} = 3.3 \pm 0.3\text{ V}$

Item	Symbol	Ta = 25°C			Ta = −40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	$t_{PLH}$ $t_{PHL}$	—	4.6	7.5	1.0	9.0	ns	$C_L = 15\text{ pF}$	A	Y
		—	5.9	11.0	1.0	12.5		$C_L = 50\text{ pF}$		
Enable time	$t_{ZH}$ $t_{ZL}$	—	6.2	10.6	1.0	12.5	ns	$C_L = 15\text{ pF}$	$\overline{OE}$	Y
		—	7.5	14.1	1.0	16.0		$C_L = 50\text{ pF}$		
Disable time	$t_{HZ}$ $t_{LZ}$	—	8.3	12.5	1.0	13.5	ns	$C_L = 15\text{ pF}$	$\overline{OE}$	Y
		—	11.8	15.0	1.0	17.0		$C_L = 50\text{ pF}$		

Switching Characteristics (cont)

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

		Ta = 25°C			Ta = -40 to 85°C				FROM (Input)	TO (Output)
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions		
Propagation delay time	t <sub>PLH</sub>	—	3.4	5.5	1.0	6.5	ns	C <sub>L</sub> = 15 pF	A	Y
	t <sub>PHL</sub>	—	4.4	7.5	1.0	8.5		C <sub>L</sub> = 50 pF		
Enable time	t <sub>ZH</sub>	—	4.6	7.3	1.0	8.5	ns	C <sub>L</sub> = 15 pF	$\overline{OE}$	Y
	t <sub>ZL</sub>	—	5.6	9.3	1.0	10.5		C <sub>L</sub> = 50 pF		
Disable time	t <sub>HZ</sub>	—	7.4	12.2	1.0	13.5	ns	C <sub>L</sub> = 15 pF	$\overline{OE}$	Y
	t <sub>LZ</sub>	—	9.7	14.2	1.0	15.5		C <sub>L</sub> = 50 pF		

Output-skew Characteristics

- $C_L = 50\text{ pF}$

Item	Symbol	$V_{CC}\text{ (V)}$	$T_a = 25^\circ\text{C}$		$T_a = -40\text{ to }85^\circ\text{C}$		Unit
			Min	Max	Min	Max	
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

- $C_L = 50\text{ pF}$

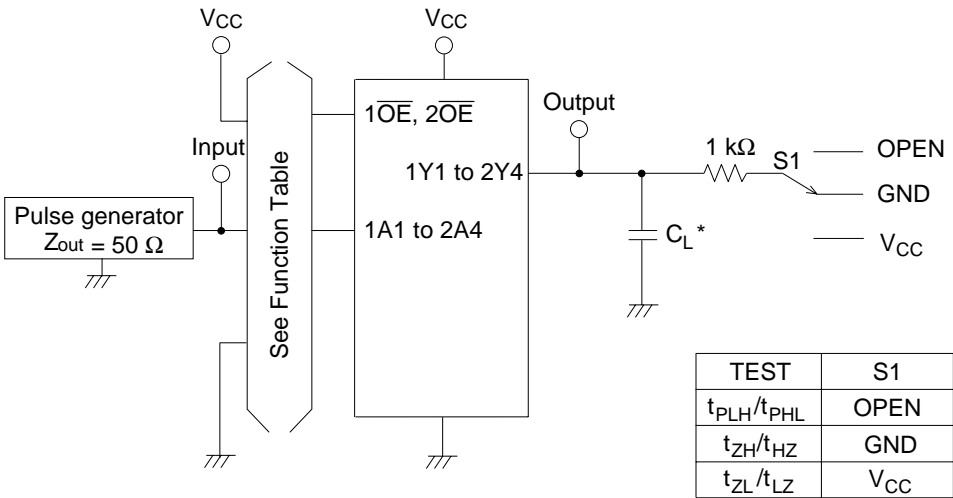
Item	Symbol	$V_{CC}\text{ (V)}$	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	$C_{PD}$	3.3	—	14.0	—	pF	$f = 10\text{ MHz}$
		5.0	—	16.4	—		

Noise Characteristics

- $C_L = 50\text{ pF}$

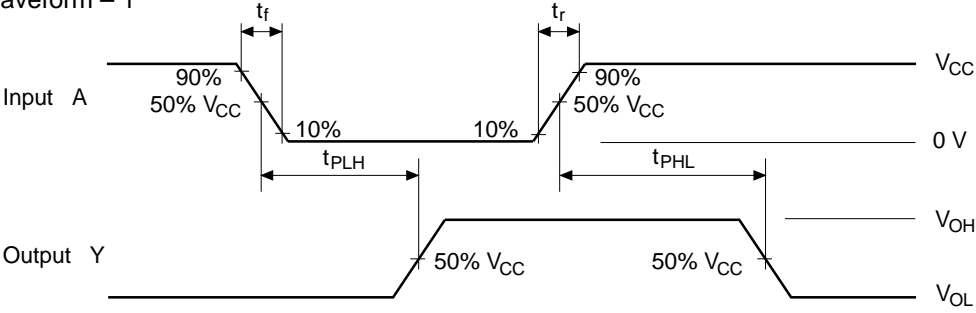
Item	Symbol	$V_{CC}\text{ (V)}$	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Quiet output, maximum dynamic $V_{OL}$	$V_{OL(P)}$	3.3	—	0.6	0.8	V	
Quiet output, minimum dynamic $V_{OL}$	$V_{OL(V)}$	3.3	—	−0.5	−0.8		
Quiet output, minimum dynamic $V_{OH}$	$V_{OH(V)}$	3.3	—	2.8	—		
High-level 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

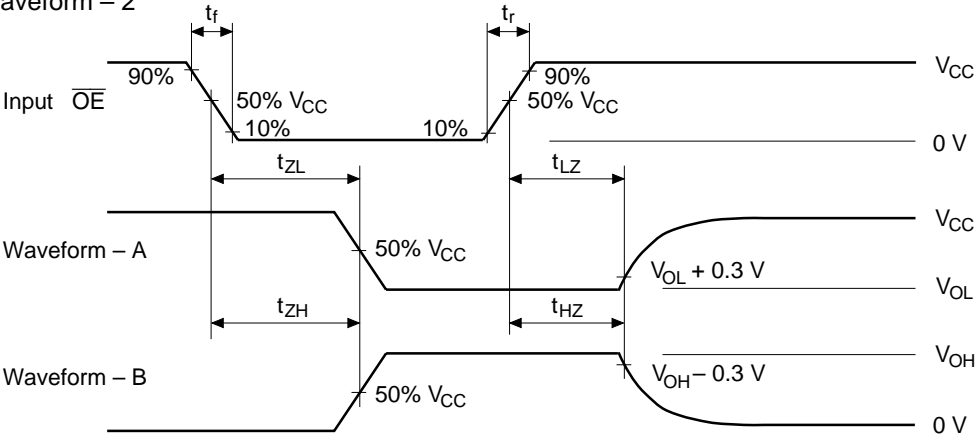


Note:  $C_L$  includes the probe and jig capacitance.

• Waveform – 1



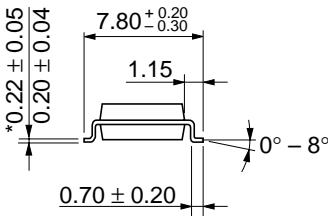
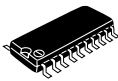
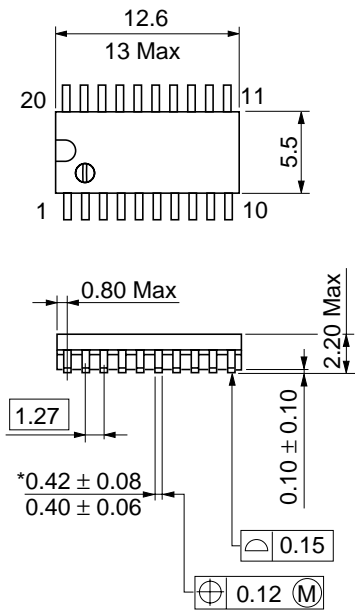
• Waveform – 2



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

Package Dimensions

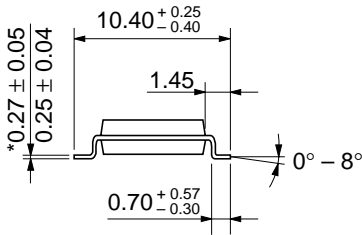
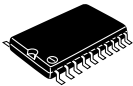
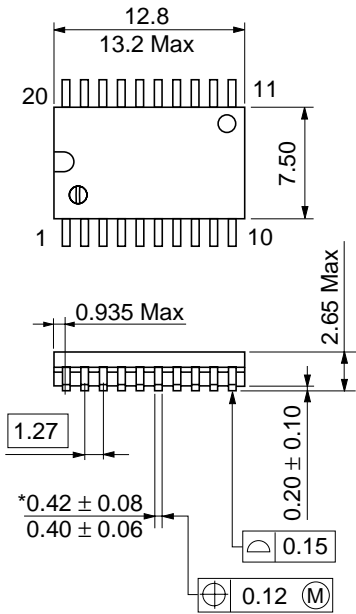
Unit: mm



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

\*Dimension including the plating thickness  
Base material dimension

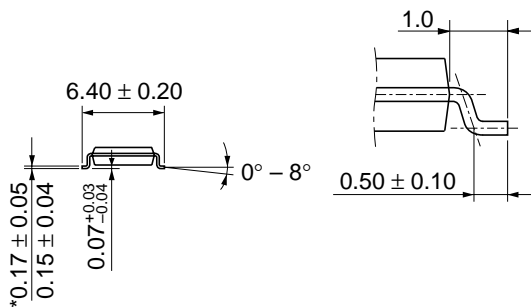
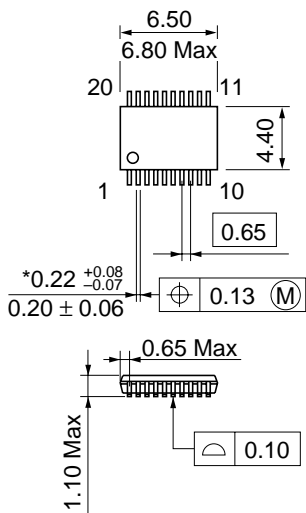
Unit: mm



\*Dimension including the plating thickness  
Base material dimension

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

Unit: mm


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

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

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