

# HD74LV245A

## Octal Bus Transceivers with 3-state Outputs

# HITACHI

ADE-205-247 (Z)  
1st Edition  
March 1999

### Description

The HD74LV245A has eight buffers with three-state outputs in a 20-pin package. When DIR is high, data is transferred from the A inputs to the B outputs, and when DIR is low, data is transferred from the B inputs to the A outputs. The A and B buses are separated by making the enable input ( $\overline{OE}$ ) high level. 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  $V_{IH}(\text{Max.}) = 5.5\text{ V}$  ( $@V_{CC} = 0\text{ V}$  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  $\pm 8\text{ mA}$  ( $@V_{CC} = 3.0\text{ V}$  to  $3.6\text{ V}$ ),  $\pm 16\text{ mA}$  ( $@V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ )

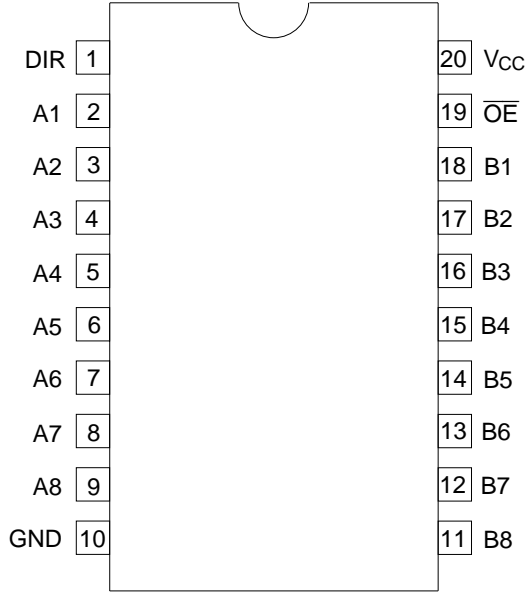
### Function Table

#### Inputs

$\overline{OE}$	DIR	Operation
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

Note: H: High level  
L: Low level  
X: Immaterial

## 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	$I_{OK}$	$\pm 50$	mA	$V_O < 0$ or $V_O > V_{CC}$
Continuous output current	$I_O$	$\pm 35$	mA	$V_O = 0$ to $V_{CC}$
Continuous current through $V_{CC}$ or GND	$I_{CC}$ or $I_{GND}$	$\pm 70$	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	$^\circ\text{C}$	

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..

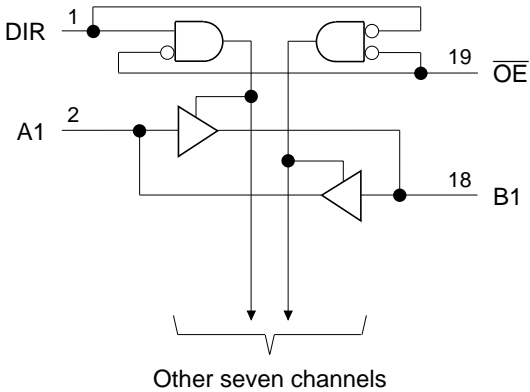
1. The input and output voltage ratings may be exceeded even if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The data above are measured by  $\Delta V_{BE}$  method mounting on glass epoxy board ( $40 \times 40 \times 1.6$  mm) with 10% of wiring density.

**Recommended Operating Conditions**

<b>Item</b>	<b>Symbol</b>	<b>Min</b>	<b>Max</b>	<b>Unit</b>	<b>Conditions</b>
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: H or L
		0	5.5		High impedance state
Output current	$I_{OH}$	—	-50	$\mu A$	$V_{CC} = 2.0 V$
		—	-2	mA	$V_{CC} = 2.3 \text{ to } 2.7 V$
		—	-8		$V_{CC} = 3.0 \text{ to } 3.6 V$
		—	-16	$V_{CC} = 4.5 \text{ to } 5.5 V$	
	$I_{OL}$	—	50	$\mu A$	$V_{CC} = 2.0 V$
		—	2	mA	$V_{CC} = 2.3 \text{ to } 2.7 V$
		—	8		$V_{CC} = 3.0 \text{ to } 3.6 V$
		—	16	$V_{CC} = 4.5 \text{ to } 5.5 V$	
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

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

Item	Symbol	$V_{CC}$ (V)*1	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	$I_{OZ}^{*2}$	5.5	—	—	$\pm 5$	$\mu\text{A}$	$V_O = V_{CC} \text{ or GND}$
Quiescent supply current	$I_{CC}$	5.5	—	—	20	$\mu\text{A}$	$V_{IN} = V_{CC} \text{ or GND, } I_O = 0$
Output leakage current	$I_{OFF}$	0	—	—	5	$\mu\text{A}$	$V_O = 5.5 \text{ V}$
Input capacitance	$C_{IN}$	3.3	—	3.0	—	pF	$V_I = V_{CC} \text{ or GND}$
Output capacitance	$C_O$	3.3	—	5.5	—	pF	$V_O = V_{CC} \text{ or GND}$

Notes: 1. For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.

2. For I/O ports, the parameter  $I_{OZ}$  includes the input leakage current.

**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	$t_{PLH}$	—	8.3	13.0	1.0	15.0	ns	$C_L = 15 \text{ pF}$	A or B	B or A
	$t_{PHL}$	—	11.2	15.9	1.0	18.0				
Enable time	$t_{ZH}$	—	11.8	19.9	1.0	22.0	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	A or B
	$t_{ZL}$	—	14.1	22.7	1.0	26.0				
Disable time	$t_{HZ}$	—	11.8	18.1	1.0	20.0	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	A or B
	$t_{LZ}$	—	17.6	23.1	1.0	25.0				

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

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	$t_{PLH}$	—	5.9	8.4	1.0	10.0	ns	$C_L = 15 \text{ pF}$	A or B	B or A
	$t_{PHL}$	—	7.9	11.9	1.0	13.5				
Enable time	$t_{ZH}$	—	8.2	13.2	1.0	15.5	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	A or B
	$t_{ZL}$	—	9.9	16.7	1.0	19.0				
Disable time	$t_{HZ}$	—	9.6	16.5	1.0	19.5	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	A or B
	$t_{LZ}$	—	13.9	19.8	1.0	22.0				

## Switching Characteristics (cont)

- $V_{CC} = 5.0 \pm 0.5$  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	$t_{PLH}$	—	4.3	5.5	1.0	6.5	ns	$C_L = 15$ pF	A or B	B or A
	$t_{PHL}$	—	5.6	7.5	1.0	8.5				
Enable time	$t_{ZH}$	—	5.7	8.5	1.0	10.0	ns	$C_L = 15$ pF	$\overline{OE}$	A or B
	$t_{ZL}$	—	7.0	10.6	1.0	12.0				
Disable time	$t_{HZ}$	—	7.8	12.8	1.0	14.2	ns	$C_L = 15$ pF	$\overline{OE}$	A or B
	$t_{LZ}$	—	10.9	14.7	1.0	16.0				



## 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 me package switching in the same direction. This parameter is warranted but not production tested.

## Operating Characteristics

- $C_L = 50 \text{ pF}$

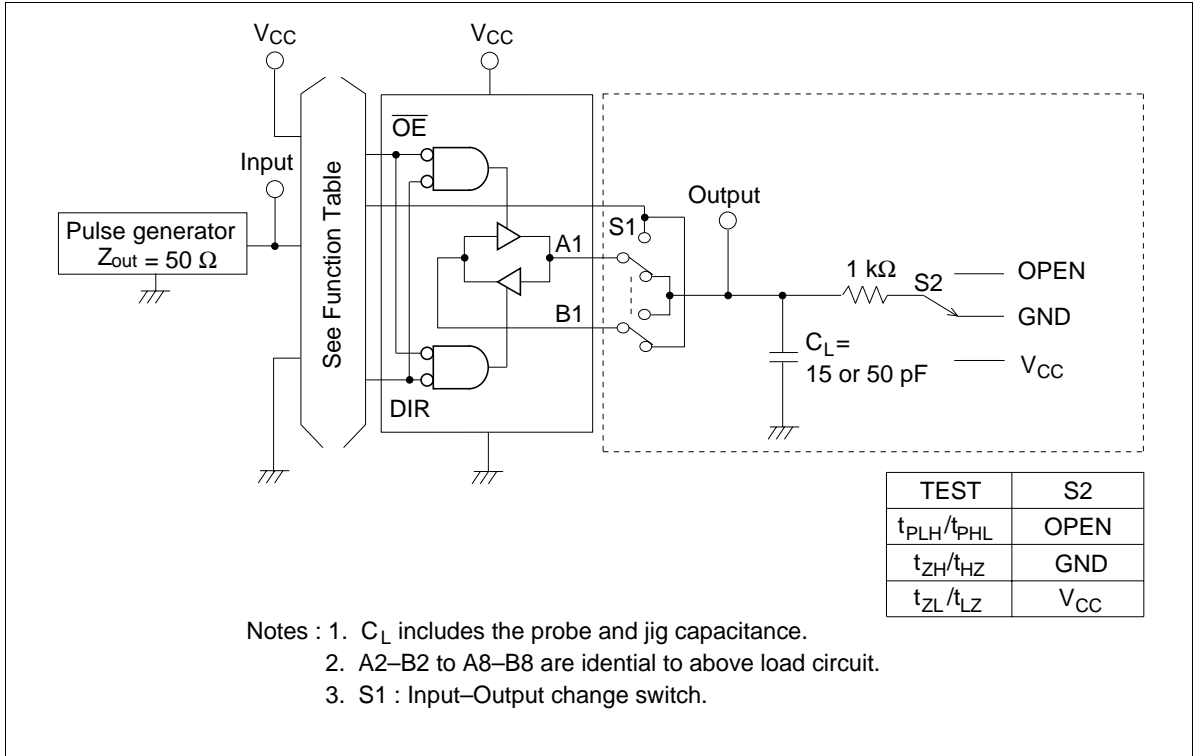
Item	Symbol	$V_{CC} \text{ (V)}$	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	$C_{PD}$	3.3	—	20.0	—	pF	$f = 10 \text{ MHz}$
		5.0	—	25.0	—		

## Noise Characteristics

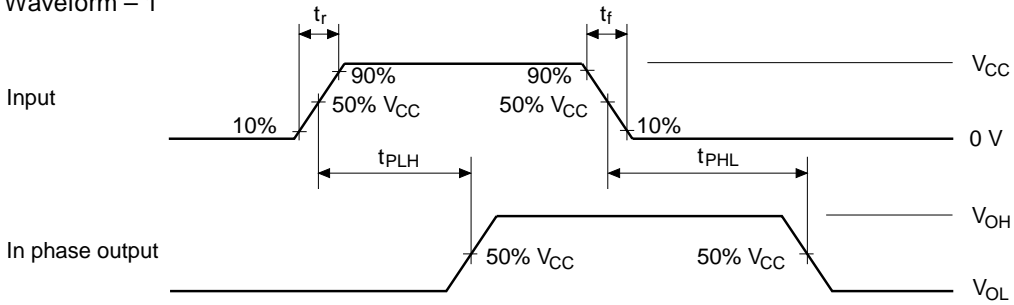
- $C_L = 50 \text{ pF}$

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	—	0.5	0.8	V	
Quiet output, minimum dynamic $V_{OL}$	$V_{OL(V)}$	3.3	—	-0.4	-0.8		
Quiet output, minimum dynamic $V_{OH}$	$V_{OH(V)}$	3.3	—	2.9	—	V	
High-level dynamic input voltage	$V_{IH(D)}$	3.3	2.31	—	—		
Low level dynamic inout voltage	$V_{IL(D)}$	3.3	—	—	0.99		

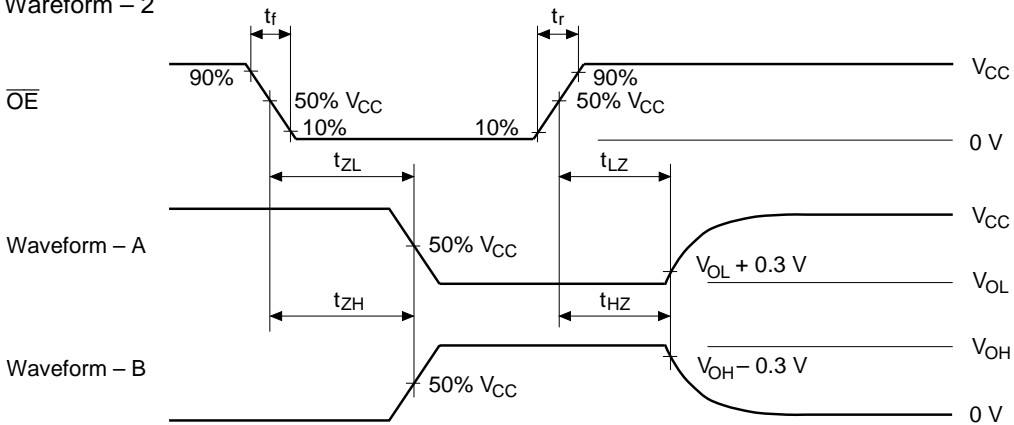
## Test Circuit



• Waveform – 1



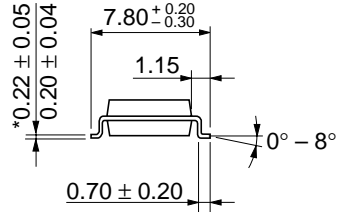
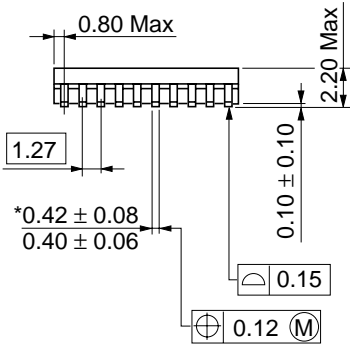
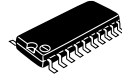
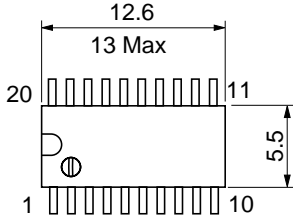
• Waveform – 2



- 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

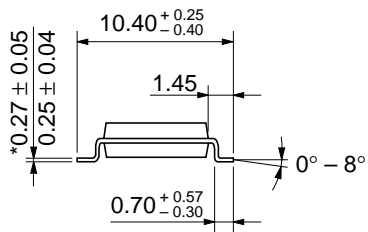
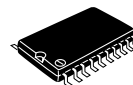
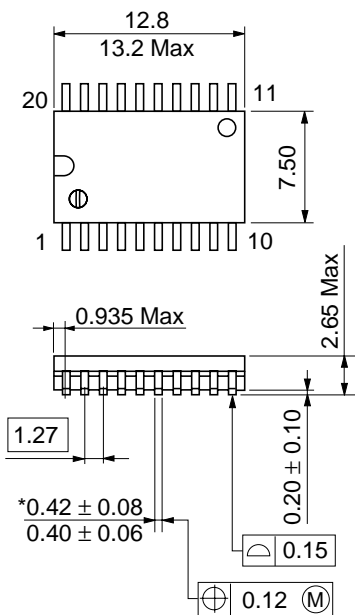
Unit: mm



\*Dimension including the plating thickness  
 Base material dimension

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

Unit: mm

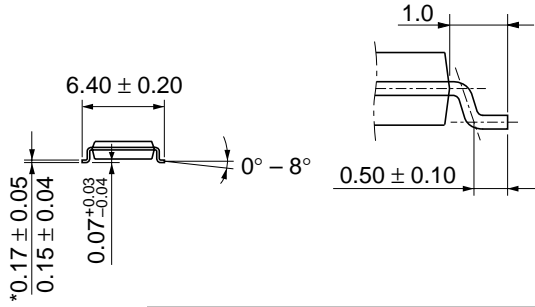
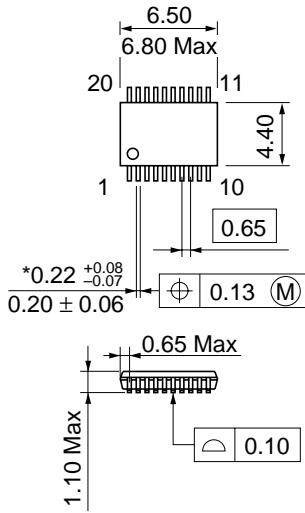


\*Dimension including the plating thickness  
 Base material dimension

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

# HD74LV245A

Unit: mm



\*Dimension including the plating thickness  
Base material dimension

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

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