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# HD74LVC245A

Octal Bidirectional Transceivers with 3-state Outputs

## HITACHI

ADE-205-111B(Z)  
3rd Edition  
December 1996

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### Description

The HD74LVC245A has eight buffers with three state outputs in a 20 pin package. When (T /  $\bar{R}$ ) is high, data flows from the A inputs to the B outputs, and when (T /  $\bar{R}$ ) is low, data flows from the B inputs to the A outputs. A and B bus are separated by making enable input ( $\overline{OE}$ ) high level. Low voltage and high speed operation is suitable at the battery drive product (note type personal computer) and low power consumption extends the life of a battery for long time operation.

### Features

- $V_{CC} = 2.0\text{ V to }5.5\text{ V}$
- All inputs  $V_{IH}(\text{Max.}) = 5.5\text{ V}$  (@ $V_{CC} = 0\text{ V to }5.5\text{ V}$ )
- All input outputs  $V_{IO}(\text{Max.}) = 5.5\text{ V}$  (@ $V_{CC} = 0\text{ V}$  or output off state)
- 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  $> 2.0\text{ V}$  (@ $V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- High output current  $\pm 24\text{ mA}$  (@ $V_{CC} = 3.0\text{ V to }5.5\text{ V}$ )

### Function Table

Inputs		Operation
$\overline{OE}$	T / $\bar{R}$	
L	L	B data to A bus
L	H	A data to B bus
H	X	Z

H : High level

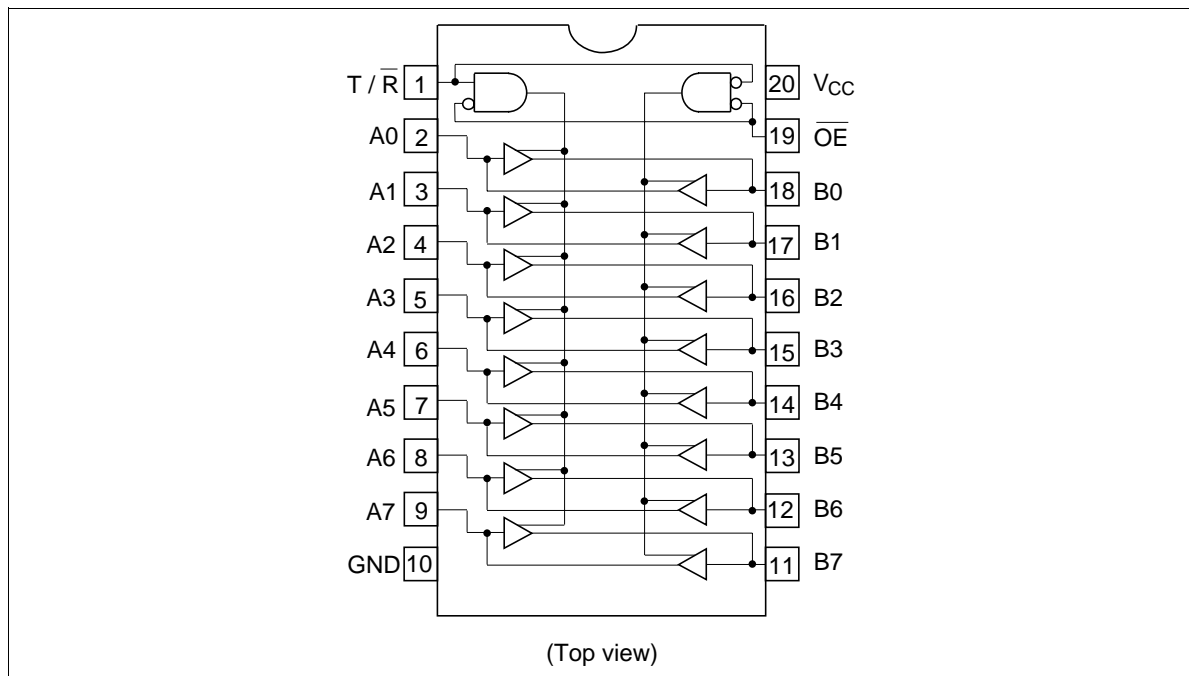
L : Low level

X : Immaterial

Z : High impedance

# HD74LVC245A

## Pin Arrangement



## Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	$V_{CC}$	-0.5 to 6.0	V	
Input diode current	$I_{IK}$	-50	mA	$V_I = -0.5\text{ V}$
Input voltage	$V_I$	-0.5 to 6.0	V	$T / \bar{R}, \bar{OE}$
Output diode current	$I_{OK}$	-50	mA	$V_O = -0.5\text{ V}$
		50	mA	$V_O = V_{CC} + 0.5\text{ V}$
Input / output voltage	$V_{IO}$	-0.5 to $V_{CC} + 0.5$	V	Output "H" or "L"
		-0.5 to 6.0	V	Output "Z" or $V_{CC}$ :OFF
Output current	$I_O$	$\pm 50$	mA	
$V_{CC}$ , GND current / pin	$I_{CC}$ or $I_{GND}$	100	mA	
Storage temperature	Tstg	-65 to 150	$^{\circ}\text{C}$	

Note: 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.

**Recommended Operating Conditions**

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	$V_{CC}$	1.5 to 5.5	V	Data retention
		2.0 to 5.5	V	At operation
Input / output voltage	$V_I$	0 to 5.5	V	T / $\overline{R}$ , $\overline{OE}$
	$V_{IO}$	0 to $V_{CC}$	V	Output "H" or "L"
		0 to 5.5	V	Output "Z" or $V_{CC}$ :OFF
Operating temperature	$T_a$	-40 to 85	°C	
Output current	$I_{OH}$	-12	mA	$V_{CC} = 2.7\text{ V}$
		-24 <sup>2</sup>	mA	$V_{CC} = 3.0\text{ V to }5.5\text{ V}$
	$I_{OL}$	12	mA	$V_{CC} = 2.7\text{ V}$
		24 <sup>2</sup>	mA	$V_{CC} = 3.0\text{ V to }5.5\text{ V}$
Input rise / fall time <sup>*1</sup>	$t_r, t_f$	10	ns/V	

Notes: 1. This item guarantees maximum limit when one input switches.

Waveform : Refer to test circuit of switching characteristics.

2. duty cycle ≤ 50%

# HD74LVC245A

## Electrical Characteristics

Item	Symbol	$V_{CC}$ (V)	$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit	Test Conditions
			Min	Max		
Input voltage	$V_{IH}$	2.7 to 3.6	2.0	—	V	
		4.5 to 5.5	$V_{CC} \times 0.7$	—	V	
	$V_{IL}$	2.7 to 3.6	—	0.8	V	
		4.5 to 5.5	—	$V_{CC} \times 0.3$	V	
Output voltage	$V_{OH}$	2.7 to 5.5	$V_{CC} - 0.2$	—	V	$I_{OH} = -100 \mu\text{A}$
		2.7	2.2	—	V	$I_{OH} = -12 \text{ mA}$
		3.0	2.4	—	V	
		3.0	2.2	—	V	$I_{OH} = -24 \text{ mA}$
		4.5	3.8	—	V	
	$V_{OL}$	2.7 to 5.5	—	0.2	V	$I_{OL} = 100 \mu\text{A}$
		2.7	—	0.4	V	$I_{OL} = 12 \text{ mA}$
		3.0	—	0.55	V	$I_{OL} = 24 \text{ mA}$
		4.5	—	0.55	V	
Input current	$I_{IN}$	0 to 5.5	—	$\pm 5.0$	$\mu\text{A}$	$V_{IN} = 5.5 \text{ V or GND}$
Off state output current	$I_{OZ}$	2.7 to 5.5	—	$\pm 5.0$	$\mu\text{A}$	$V_{IN} = V_{CC}, \text{ GND}$ $V_{OUT} = 5.5 \text{ V or GND}$
Output leak current	$I_{OFF}$	0	—	20	$\mu\text{A}$	$V_{IN} / V_{OUT} = 5.5 \text{ V}$
Quiescent supply current	$I_{CC}$	2.7 to 3.6	—	$\pm 10$	$\mu\text{A}$	$V_{IN} / V_{OUT} = 3.6 \text{ to } 5.5 \text{ V}$
		2.7 to 5.5	—	10	$\mu\text{A}$	$V_{IN} = V_{OUT} \text{ or GND}$
	$\Delta I_{CC}$	3.0 to 3.6	—	500	$\mu\text{A}$	$V_{IN} = \text{one input at } (V_{CC} - 0.6)\text{V},$ $\text{other inputs at } V_{CC} \text{ or GND}$

Switching Characteristics

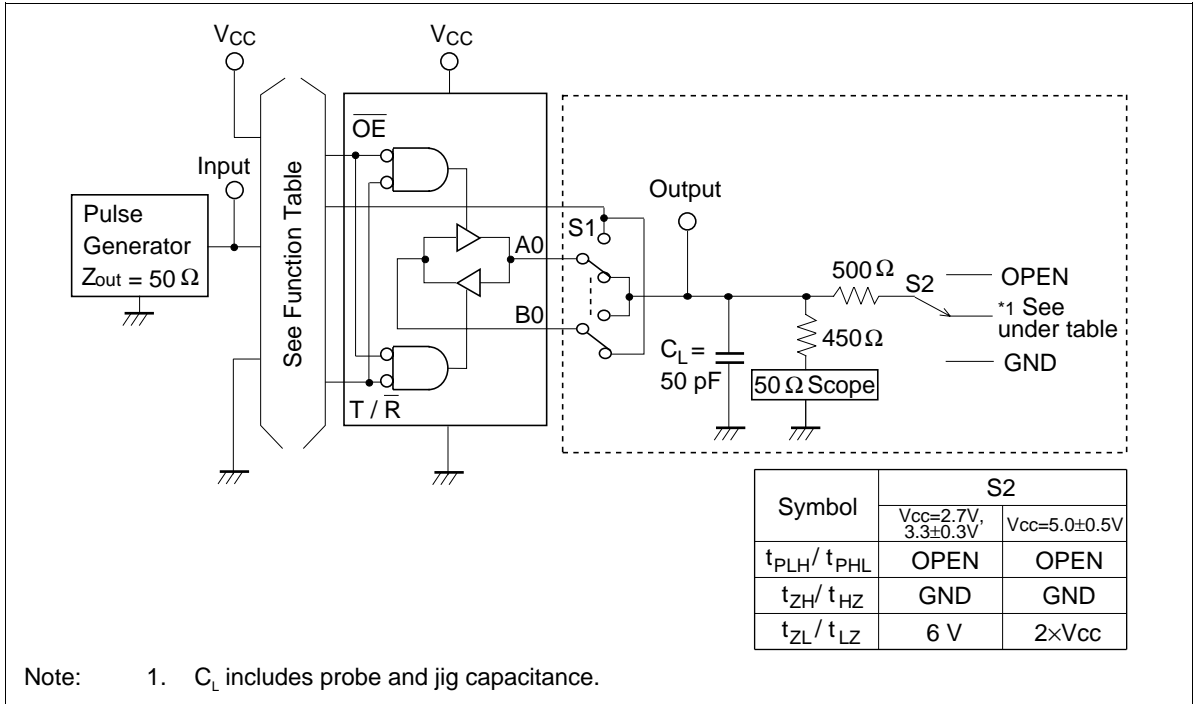
Item	Symbol	V <sub>cc</sub> (V)	Ta = -40 to 85°C			Unit	From (Input)	To (Output)
			Min	Typ	Max			
Propagation delay time	t <sub>PLH</sub>	2.7	—	—	8.0	ns	A or B	B or A
	t <sub>PHL</sub>	3.3±0.3	1.5	—	7.0	ns		
		5.0±0.5	—	—	5.5	ns		
Output enable time	t <sub>ZH</sub>	2.7	—	—	9.5	ns	$\overline{\text{OE}}$	A or B
	t <sub>ZL</sub>	3.3±0.3	1.5	—	8.5	ns		
		5.0±0.5	—	—	7.0	ns		
Output disable time	t <sub>ZH</sub>	2.7	—	—	8.5	ns	$\overline{\text{OE}}$	A or B
	t <sub>ZL</sub>	3.3±0.3	1.5	—	7.5	ns		
		5.0±0.5	—	—	6.5	ns		
Between outut pins skew <sup>*1</sup>	t <sub>OSLH</sub>	2.7	—	—	—	ns		
	t <sub>OSHL</sub>	3.3±0.3	—	—	1.0	ns		
		5.0±0.5	—	—	1.0	ns		
Input capacitance	C <sub>IN</sub>	2.7	—	3.0	—	pF		
Output capacitance	C <sub>O</sub>	2.7	—	15.0	—	pF		

Note: 1. This parameter is characterized but not tested.

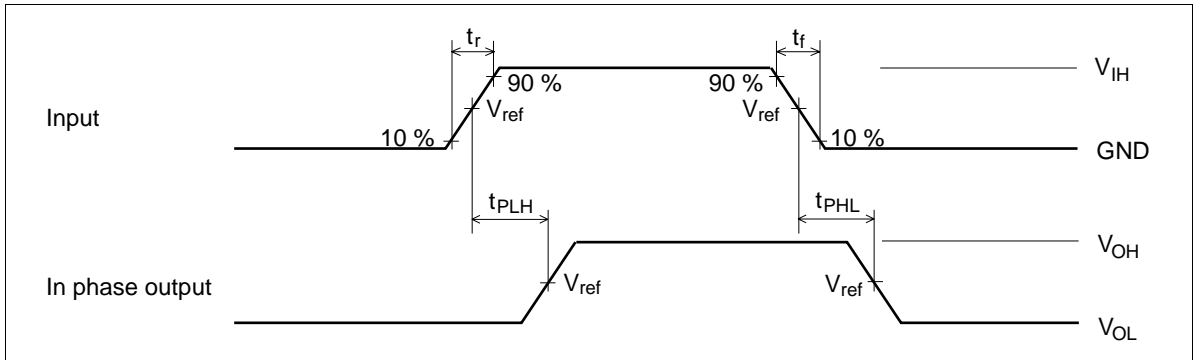
$$tos_{LH} = |t_{PLHm} - t_{PLHn}|, tos_{HL} = |t_{PHLm} - t_{PHLn}|$$

# HD74LVC245A

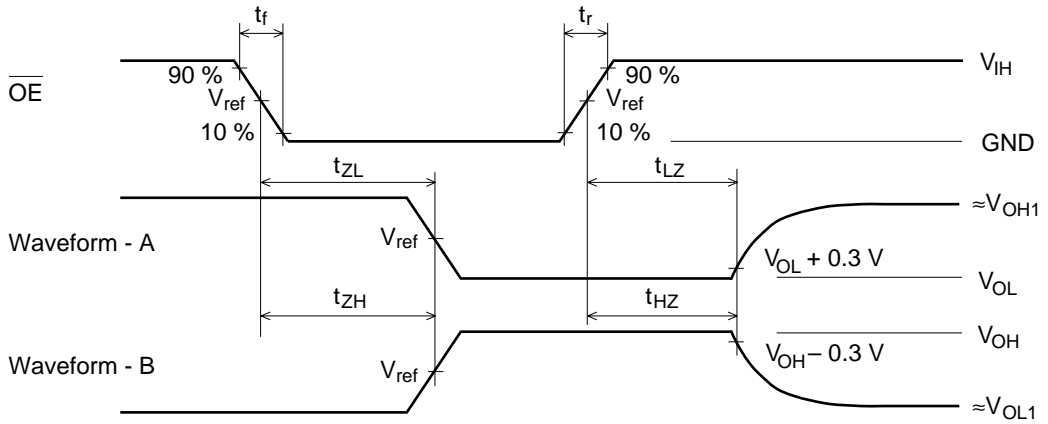
## Test Circuit



## Waveforms – 1

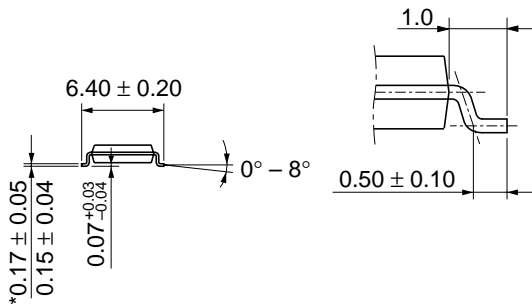
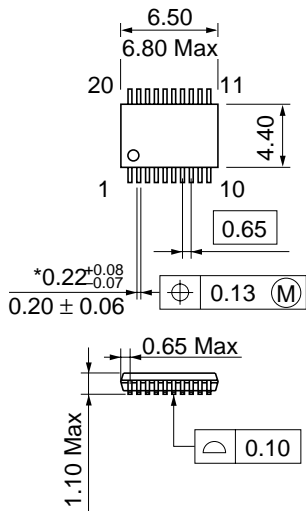


Waveforms – 2



TEST	$V_{CC}=2.7V, 3.3\pm 0.3V$	$V_{CC}=5.0\pm 0.5V$
$V_{IH}$	2.7 V	$V_{CC}$
$V_{ref}$	1.5 V	$50\%V_{CC}$
$V_{OH1}$	3 V	$V_{CC}$
$V_{OL1}$	GND	GND

- Notes:
- $t_r = 2.5 \text{ ns}, t_f = 2.5 \text{ ns}$
  - Input waveform : PRR = 10 MHz, duty cycle 50%
  - Waveform – A shows input conditions such that the output is "L" level when enable by the output control.
  - Waveform – B shows input conditions such that the output is "H" level when enable by the output control.



\*Dimension including the plating thickness  
Base material dimension

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



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