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# HD74LVC16244A

16-bit Buffers / Line Drivers with 3-state Outputs

## HITACHI

ADE-205-119B(Z)  
3rd Edition  
Decemver 1996

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### Description

The HD74LVC16244A has sixteen line drivers with three state outputs in a 48 pin package. This device is a non inverting buffer and has two active low enables ( $1\bar{G}$  to  $4\bar{G}$ ). Each enable independently controls four buffers. 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 outputs  $V_{OUT}(\text{Max.}) = 5.5\text{ V}$  ( $@V_{CC} = 0\text{ V}$  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  $\pm 24\text{ mA}$  ( $@V_{CC} = 3.0\text{ V to }5.5\text{ V}$ )

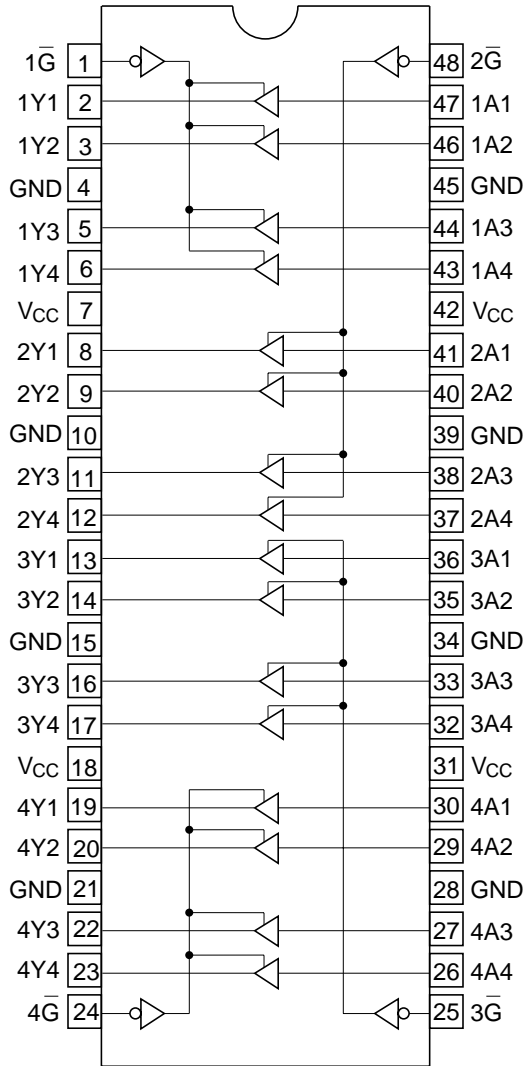
### Function Table

Inputs		Output Y
$\bar{G}$	A	
H	X	Z
L	H	H
L	L	L

H: High level  
L: Low level  
X: Immaterial  
Z: High impedance

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## Pin Arrangement



(Top view)

### 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	$V_I = -0.5$ V
Input voltage	$V_I$	-0.5 to 6.0	V	
Output diode current	$I_{OK}$	-50	mA	$V_O = -0.5$ V
		50	mA	$V_O = V_{CC} + 0.5$ V
Output voltage	$V_O$	-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	°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 hold
		2.0 to 5.5	V	At operation
Input / output voltage	$V_I$	0 to 5.5	V	$\bar{G}$ , A
	$V_O$	0 to $V_{CC}$	V	Output "H" or "L"
		0 to 5.5	V	Output "Z" or $V_{CC}:OFF$
Operating temperature	Ta	-40 to 85	°C	
Output current	$I_{OH}$	-12	mA	$V_{CC} = 2.7$ V
		-24 <sup>2</sup>	mA	$V_{CC} = 3.0$ V to 5.5 V
	$I_{OL}$	12	mA	$V_{CC} = 2.7$ V
		24 <sup>2</sup>	mA	$V_{CC} = 3.0$ V to 5.5 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  $\leq 50\%$

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## Electrical Characteristics

Item	Symbol	$V_{CC}$ (V)	$T_a = -40$ 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	—	$\pm 20$	$\mu\text{A}$	$V_{IN} / V_{OUT} = 3.6$ to $5.5 \text{ V}$
		2.7 to 5.5	—	20	$\mu\text{A}$	$V_{IN} = V_{CC}$ or $\text{GND}$
	$\Delta I_{CC}$	3.0 to 3.6	—	500	$\mu\text{A}$	$V_{IN} = \text{one input at } (V_{CC} - 0.6) \text{ V,}$ other inputs at $V_{CC}$ or $\text{GND}$

Switching Characteristics

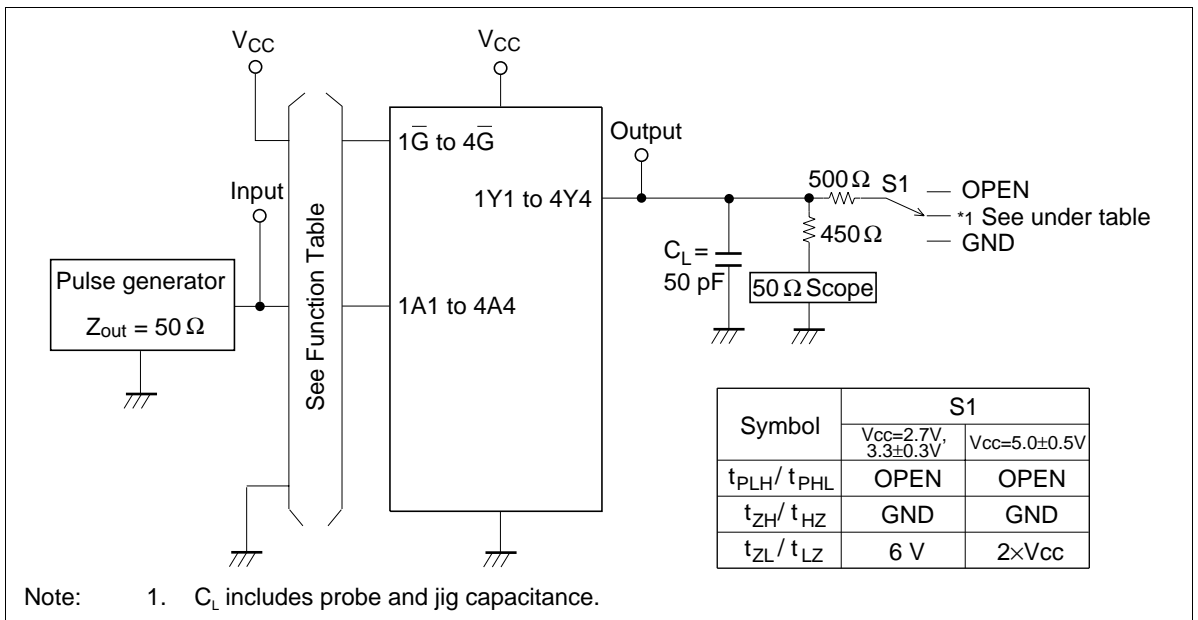
Ta = -40 to 85°C

Item	Symbol	V <sub>CC</sub> (V)	Min	Typ	Max	Unit	From (Input)	To (Output)
Propagation delay time	t <sub>PLH</sub>	2.7	—	—	5.8	ns	A	Y
	t <sub>PHL</sub>	3.3±0.3	1.5	—	5.2	ns		
		5.0±0.5	—	—	4.0	ns		
Output enable time	t <sub>ZH</sub>	2.7	—	—	8.2	ns	$\bar{G}$	Y
	t <sub>ZL</sub>	3.3±0.3	1.5	—	7.5	ns		
		5.0±0.5	—	—	5.5	ns		
Output disable time	t <sub>HZ</sub>	2.7	—	—	7.7	ns	$\bar{G}$	Y
	t <sub>LZ</sub>	3.3±0.3	1.5	—	7.0	ns		
		5.0±0.5	—	—	6.0	ns		
Between output 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.

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

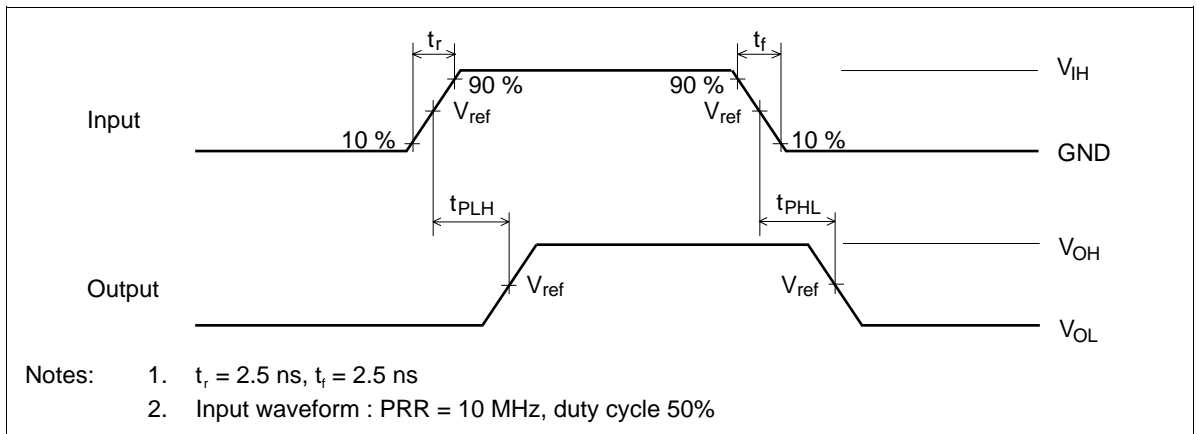
Test Circuit



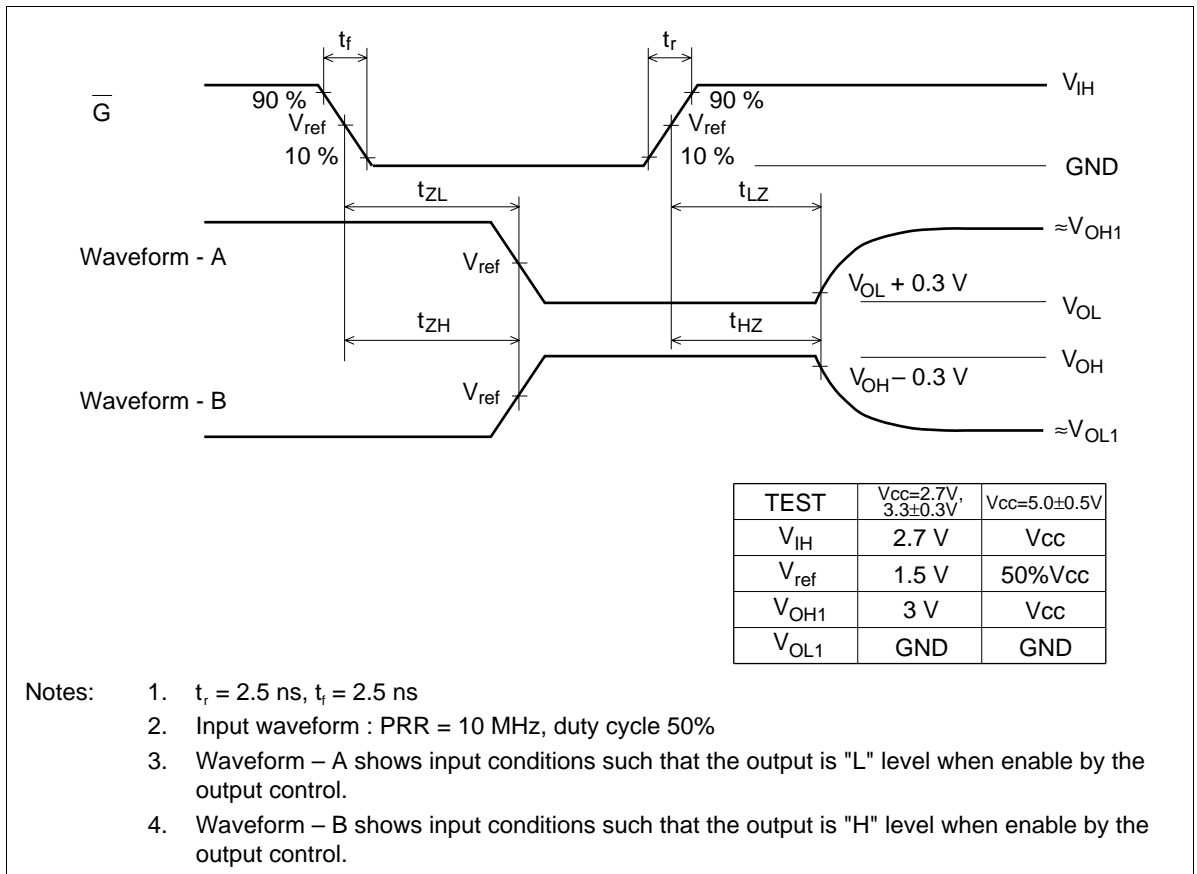
Note: 1. C<sub>L</sub> includes probe and jig capacitance.

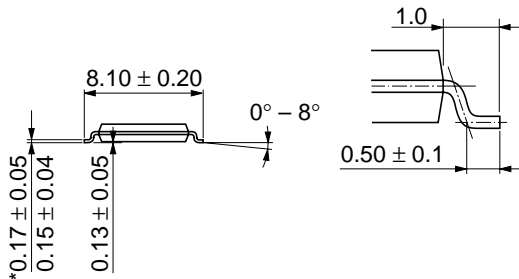
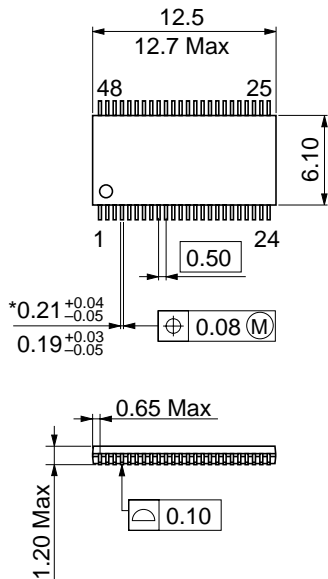
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## Waveforms – 1



## Waveforms – 2





\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	TTP-48DB
JEDEC	—
EIAJ	—
Weight (reference value)	0.20 g

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