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# HD74LVC16240A

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

## HITACHI

ADE-205-118B(Z)

3rd Edition  
December 1996

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### Description

The HD74LVC16240A has sixteen inverter drivers with three state outputs in a 48 pin package. This device is a inverting buffer and has two active low enables (1G to 4G). 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  $\pm 24\text{ mA} (@V_{CC} = 3.0\text{ V to }5.5\text{ V})$

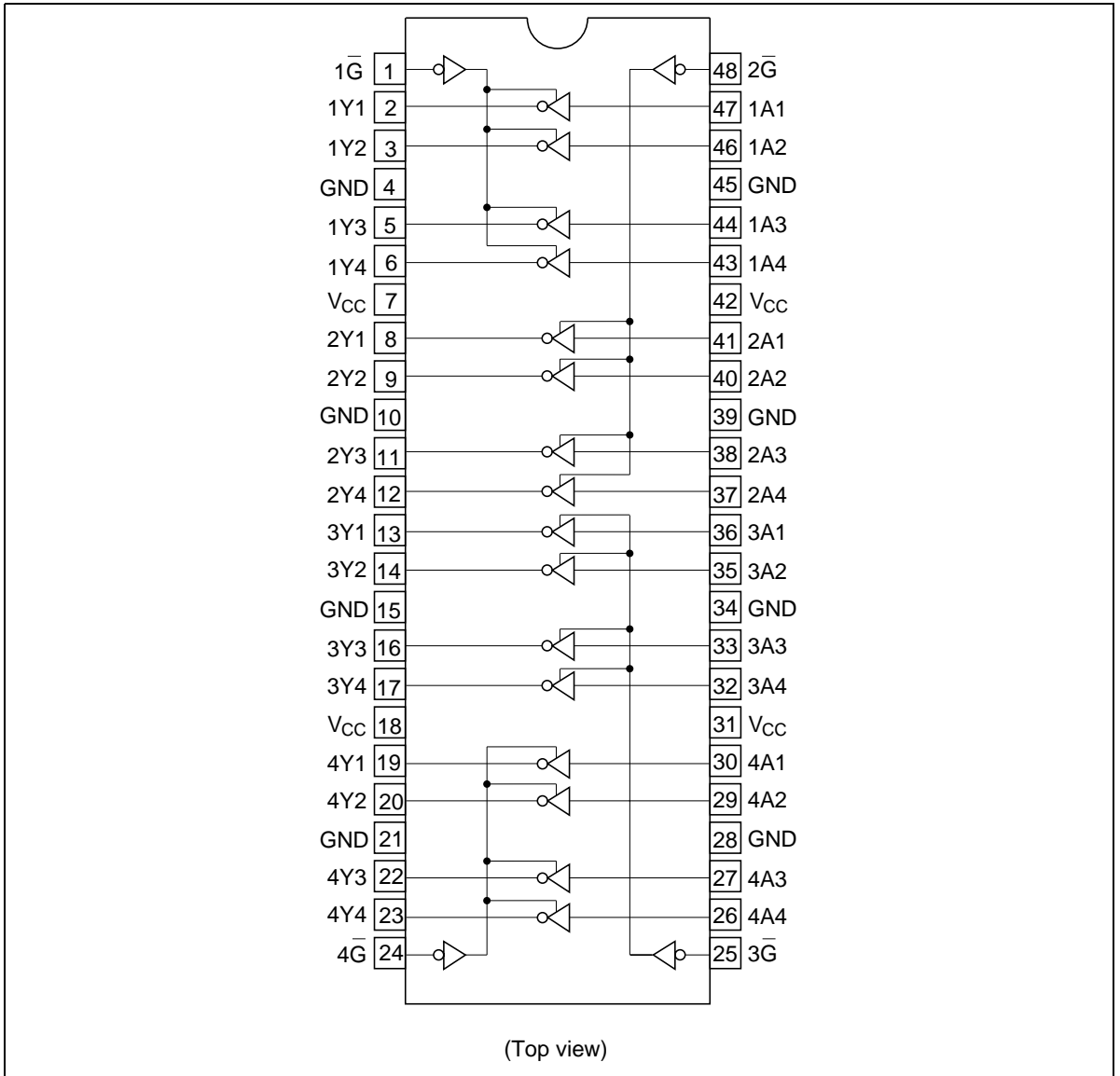
### Function Table

Inputs		Output Y
G	A	
H	X	Z
L	H	L
L	L	H

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

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## 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	$V_I = -0.5$ 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	$T_{stg}$	-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	Rating	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	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	$T_a$	-40 to 85	°C	
Output current	$I_{OH}$	-12	mA	$V_{CC} = 2.7$ V
		$-24^{*2}$	mA	$V_{CC} = 3.0$ V to 5.5 V
	$I_{OL}$	12	mA	$V_{CC} = 2.7$ V
		$24^{*2}$	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 <sub>CC</sub> (V)	Ta = -40 to 85°C		Unit	Test Conditions
			Min	Max		
Input voltage	V <sub>IH</sub>	2.7 to 3.6	2.0	—	V	
		4.5 to 5.5	V <sub>CC</sub> × 0.7	—	V	
	V <sub>IL</sub>	2.7 to 3.6	—	0.8	V	
		4.5 to 5.5	—	V <sub>CC</sub> × 0.3	V	
Output voltage	V <sub>OH</sub>	2.7 to 5.5	V <sub>CC</sub> - 0.2	—	V	I <sub>OH</sub> = -100 μA
		2.7	2.2	—	V	I <sub>OH</sub> = -12 mA
		3.0	2.4	—	V	
		3.0	2.2	—	V	I <sub>OH</sub> = -24 mA
		4.5	3.8	—	V	
	V <sub>OL</sub>	2.7 to 5.5	—	0.2	V	I <sub>OL</sub> = 100 μA
		2.7	—	0.4	V	I <sub>OL</sub> = 12 mA
		3.0	—	0.55	V	I <sub>OL</sub> = 24 mA
		4.5	—	0.55	V	
Input current	I <sub>IN</sub>	0 to 5.5	—	±5.0	μA	V <sub>IN</sub> = 5.5 V or GND
Off state output current	I <sub>OZ</sub>	2.7 to 5.5	—	±5.0	μA	V <sub>IN</sub> = V <sub>CC</sub> , GND V <sub>OUT</sub> = 5.5 V or GND
Output leak current	I <sub>OFF</sub>	0	—	20	μA	V <sub>IN</sub> / V <sub>OUT</sub> = 5.5 V
Quiescent supply current	I <sub>CC</sub>	2.7 to 3.6	—	±20	μA	V <sub>IN</sub> / V <sub>OUT</sub> = 3.6 to 5.5 V
		2.7 to 5.5	—	20	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND
	ΔI <sub>CC</sub>	3.0 to 3.6	—	500	μA	V <sub>IN</sub> = one input at (V <sub>CC</sub> - 0.6)V, other inputs at V <sub>CC</sub> or GND

Switching Characteristics

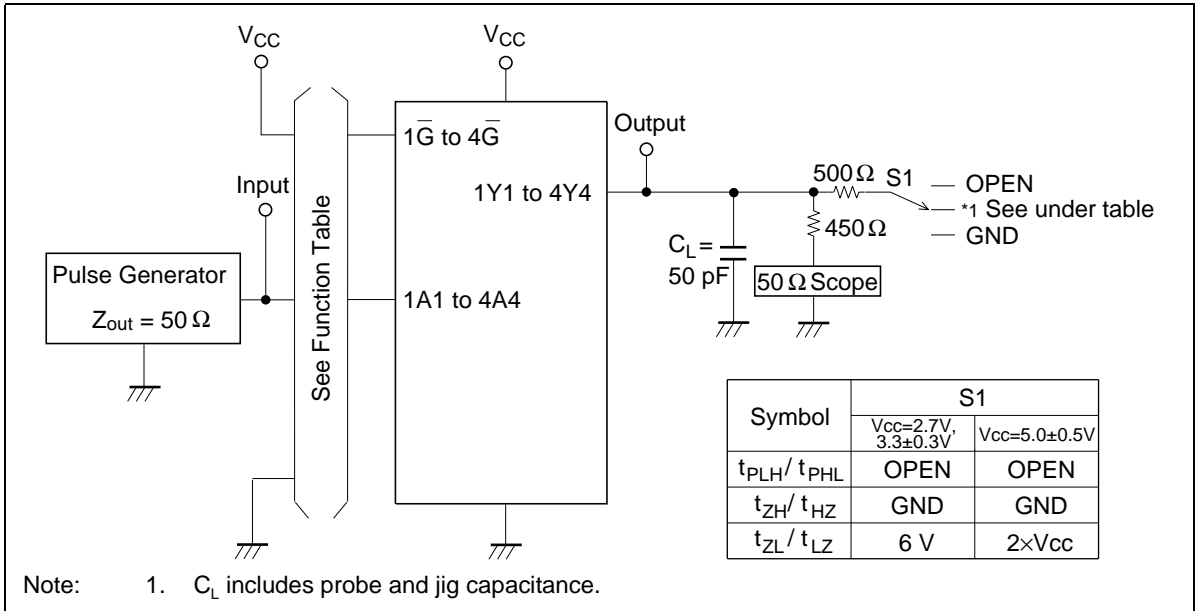
Item	Symbol	V <sub>CC</sub> (V)	Ta = -40 to 85°C			Unit	From (Input)	To (Output)
			Min	Typ	Max			
Propagation delay time	t <sub>PLH</sub>	2.7	—	—	6.2	ns	A	Y
	t <sub>PHL</sub>	3.3±0.3	1.5	—	5.5	ns		
		5.0±0.5	—	—	4.5	ns		
Output enable time	t <sub>ZH</sub>	2.7	—	—	7.7	ns	G	Y
	t <sub>ZL</sub>	3.3±0.3	1.5	—	7.0	ns		
		5.0±0.5	—	—	6.0	ns		
Output disable time	t <sub>HZ</sub>	2.7	—	—	7.7	ns	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>OSSL</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.

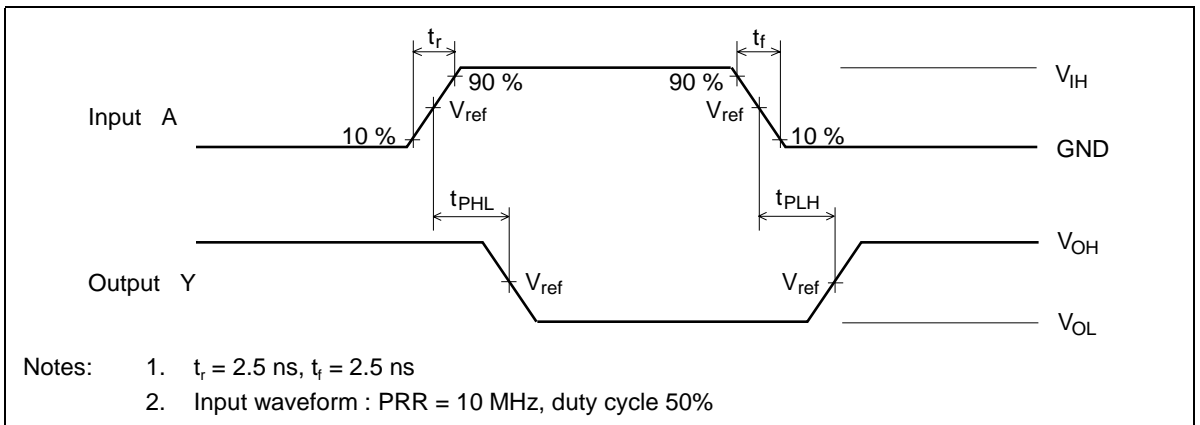
$$tos_{LH} = |t_{PLHm} - t_{PLHn}|, tos_{HL} = |t_{PHLm} - t_{PHLn}|$$

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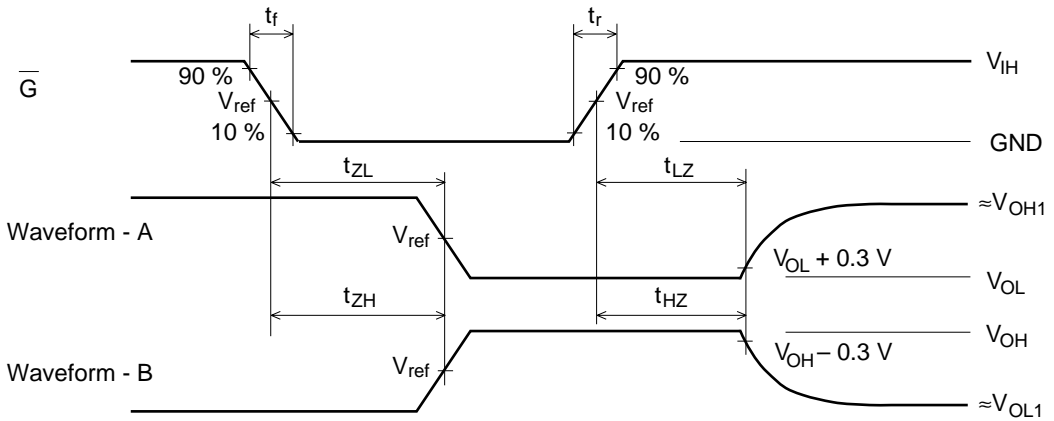
## Test Circuit



## Waveforms – 1



Waveforms – 2



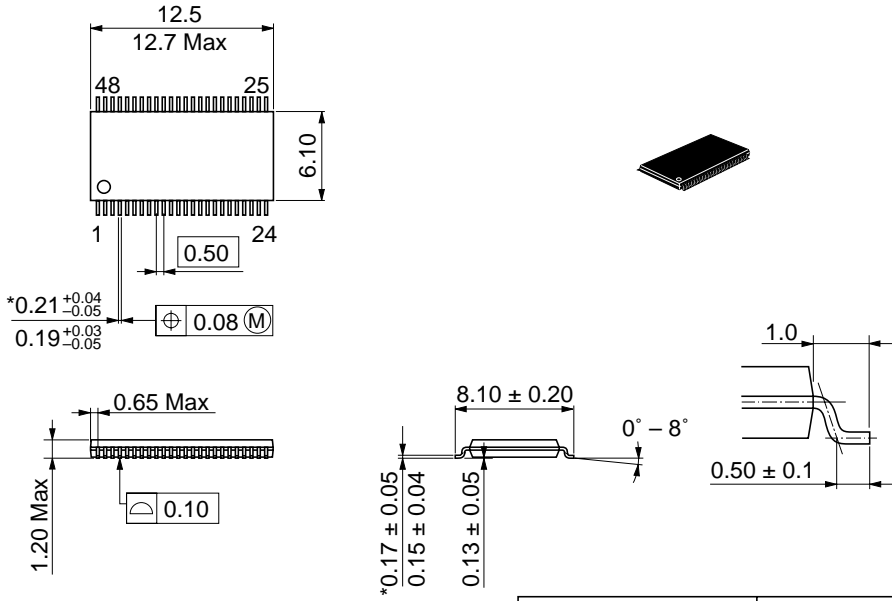
TEST	$V_{cc}=2.7V, 3.3\pm 0.3V$	$V_{cc}=5.0\pm 0.5V$
$V_{IH}$	2.7 V	$V_{cc}$
$V_{ref}$	1.5 V	50% $V_{cc}$
$V_{OH1}$	3 V	$V_{cc}$
$V_{OL1}$	GND	GND

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

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## Package Dimensions

Unit: mm



\*Dimension including the plating thickness  
Base material dimension

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



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Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL NorthAmerica : <http://semiconductor.hitachi.com/>  
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**For further information write to:**

Hitachi Semiconductor  
 (America) Inc.  
 179 East Tasman Drive,  
 San Jose, CA 95134  
 Tel: <1>(408) 433-1990  
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Hitachi Europe GmbH  
 Electronic Components Group  
 Dornacher Straße 3  
 D-85622 Feldkirchen, Munich  
 Germany  
 Tel: <49> (89) 9 9180-0  
 Fax: <49> (89) 9 29 30 00  
 Hitachi Europe Ltd.  
 Electronic Components Group.  
 Whitebrook Park  
 Lower Cookham Road  
 Maidenhead  
 Berkshire SL6 8YA, United Kingdom  
 Tel: <44> (1628) 585000  
 Fax: <44> (1628) 585160

Hitachi Asia Ltd.  
 Hitachi Tower  
 16 Collyer Quay #20-00,  
 Singapore 049318  
 Tel : <65>-538-6533/538-8577  
 Fax : <65>-538-6933/538-3877  
 URL : <http://www.hitachi.com.sg>

Hitachi Asia Ltd.  
 (Taipei Branch Office)  
 4/F, No. 167, Tun Hwa North Road,  
 Hung-Kuo Building,  
 Taipei (105), Taiwan  
 Tel : <886>-(2)-2718-3666  
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Hitachi Asia (Hong Kong) Ltd.  
 Group III (Electronic Components)  
 7/F., North Tower,  
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 Harbour City, Canton Road  
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 Hong Kong  
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