

HD74LV540A

Octal Inverted Buffers / Drivers with 3-state Outputs

HITACHI

ADE-205-277 (Z)
1st Edition
April 1999

Description

The HD74LV540A has eight inverter drivers with three state outputs in a 20 pin package. When $\overline{OE1}$ and $\overline{OE2}$ is low level, this drivers set up output is enable. 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 V operation
- All inputs V_{IH} (Max.) = 5.5 V (@ $V_{CC} = 0\text{ V}$ to 5.5 V)
- All outputs V_O (Max.) = 5.5 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 V), $\pm 16\text{ mA}$ (@ $V_{CC} = 4.5\text{ V}$ to 5.5 V)

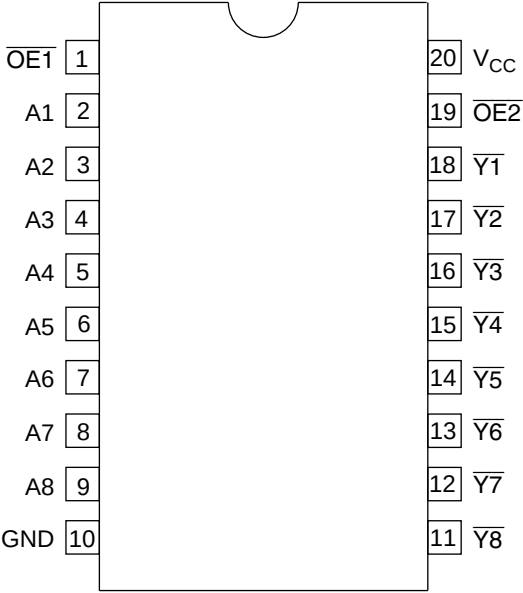
Function Table

Inputs

$\overline{OE1}$	$\overline{OE2}$	A	Output $\overline{Y}$
L	L	L	H
L	L	H	L
H	X	X	Z
X	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* ¹	V _I	−0.5 to 7.0	V	
Output voltage range* ^{1, 2}	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 Ta = 25°C (in still air)* ³	P _T	835 757	mW	SOP TSSOP
Storage temperature	Tstg	−65 to 150	°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.

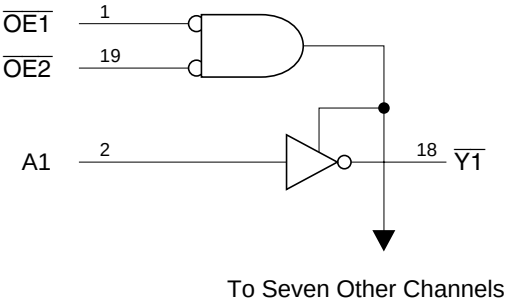
- 1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- 2. This value is limited to 5.5 V maximum.
- 3. The maximum package power dissipation was calculated using a junction temperature of 150°C.

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	μA	$V_{CC} = 2.0\text{ V}$
		—	−2	mA	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		—	−8		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		—	−16		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
	I_{OL}	—	50	μA	$V_{CC} = 2.0\text{ V}$
		—	2	mA	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		—	8		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		—	16		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
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	°C	

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

Logic Diagram



DC Electrical Characteristics

- $T_a = -40$ to 85°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	—	—	± 1	μA	$V_{IN} = 5.5\ \text{V}$ or GND
Off-state output current	I_{OZ}	5.5	—	—	± 5	μA	$V_O = V_{CC}$ or GND
Quiescent supply current	I_{CC}	5.5	—	—	20	μA	$V_{IN} = V_{CC}$ or GND, $I_O = 0$
Output leakage current	I_{OFF}	0	—	—	5	μA	V_I or $V_O = 0\ \text{V}$ to $5.5\ \text{V}$
Input capacitance	C_{IN}	3.3	—	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

• $V_{CC} = 2.5 \pm 0.2 \text{ V}$

		Ta = 25°C			Ta = -40 to 85°C					
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Propagation delay time	t _{PLH}	—	7.4	12.0	1.0	14.5	ns	C _L = 15 pF	A	Y
	t _{PHL}	—	9.3	16.8	1.0	18.5		C _L = 50 pF		
Enable time	t _{ZH}	—	8.2	17.4	1.0	21.0	ns	C _L = 15 pF	OE	Y
	t _{ZL}	—	9.6	22.2	1.0	25.5		C _L = 50 pF		
Disable time	t _{HZ}	—	7.5	16.0	1.0	19.0	ns	C _L = 15 pF	OE	Y
	t _{LZ}	—	10.5	22.3	1.0	25.5		C _L = 50 pF		

• $V_{CC} = 3.3 \pm 0.3 \text{ V}$

		Ta = 25°C			Ta = -40 to 85°C					
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Propagation delay time	t _{PLH}	—	5.3	7.0	1.0	8.5	ns	C _L = 15 pF	A	Y
	t _{PHL}	—	6.8	10.5	1.0	12.0		C _L = 50 pF		
Enable time	t _{ZH}	—	6.2	10.5	1.0	12.5	ns	C _L = 15 pF	OE	Y
	t _{ZL}	—	7.6	14.0	1.0	16.0		C _L = 50 pF		
Disable time	t _{HZ}	—	5.3	10.5	1.0	12.5	ns	C _L = 15 pF	OE	Y
	t _{LZ}	—	7.0	15.4	1.0	17.5		C _L = 50 pF		

Switching Characteristics (cont)

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

$T_a = 25^{\circ}\text{C}$ $T_a = -40 \text{ to } 85^{\circ}\text{C}$

Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Propa- gation delay time	t_{PLH}	—	3.8	5.0	1.0	6.0	ns	$C_L = 15 \text{ pF}$	A	$\bar{Y}$
	t_{PHL}	—	5.0	7.0	1.0	8.0		$C_L = 50 \text{ pF}$		
Enable time	t_{ZH}	—	4.6	7.2	1.0	8.5	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	$\bar{Y}$
	t_{ZL}	—	5.8	9.2	1.0	10.5		$C_L = 50 \text{ pF}$		
Disable time	t_{HZ}	—	3.6	6.8	1.0	8.0	ns	$C_L = 15 \text{ pF}$	$\overline{OE}$	$\bar{Y}$
	t_{LZ}	—	5.3	8.8	1.0	10.0		$C_L = 50 \text{ pF}$		

Output-skew Characteristics

Item	Symbol	V _{cc} = (V)	Ta = 25°C		Ta = −40 to 85°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 pF

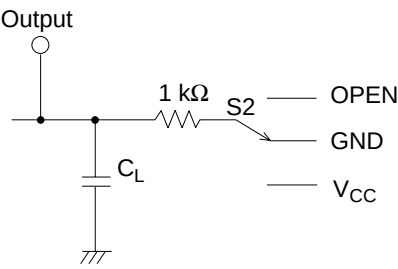
Item	Symbol	V _{cc} = (V)	Ta = 25°C			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	C _{PD}	3.3	—	23.0	—	pF	f = 10 MHz
		5.0	—	27.5	—		

Noise Characteristics

- C_L = 50 pF

Item	Symbol	V _{cc} = (V)	Ta = 25°C			Unit	Test Conditions
			Min	Typ	Max		
Quiet output, maximum dynamic V _{OL}	V _{OL (P)}	3.3	—	0.4	0.8	V	
Quiet output, minimum dynamic V _{OL}	V _{OL (V)}	3.3	—	−0.3	−0.8		
Quiet output, minimum dynamic V _{OH}	V _{OH (V)}	3.3	—	2.9	—		
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		

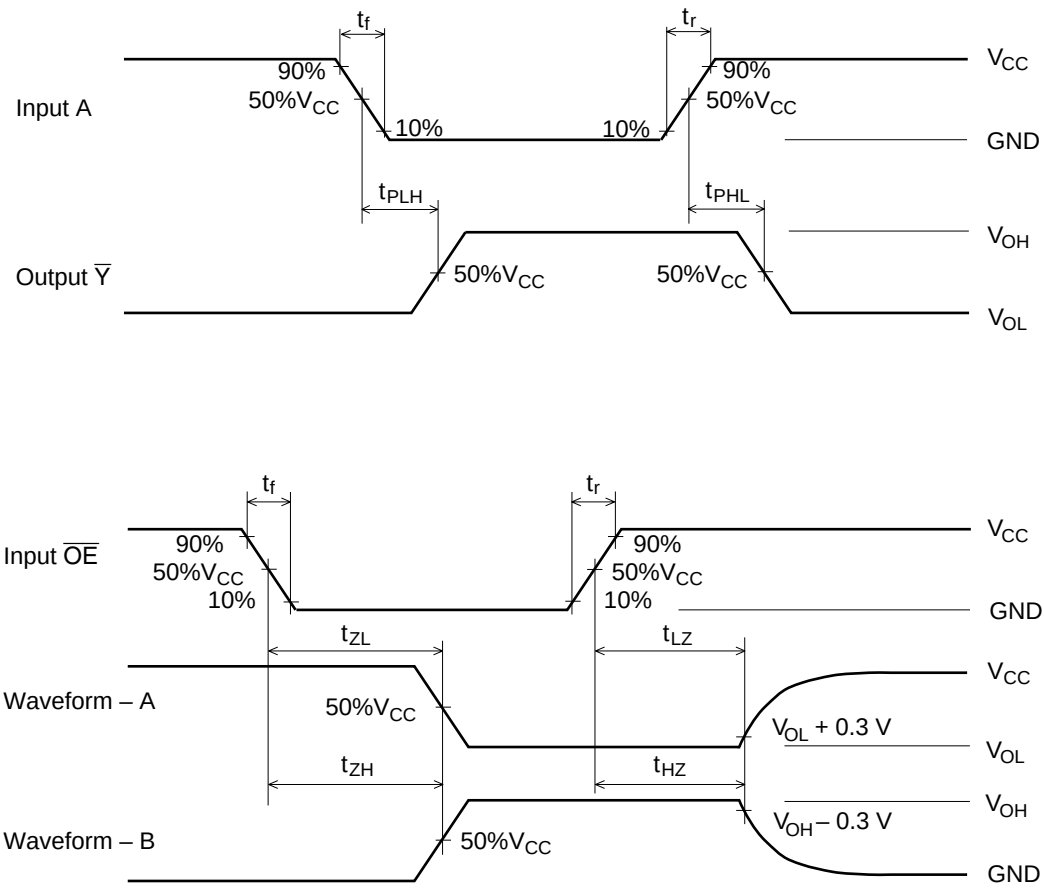
Test Circuit



TEST	S2
t_{PLH}/t_{PHL}	OPEN
t_{ZH}/t_{HZ}	GND
t_{ZL}/t_{LZ}	V_{CC}

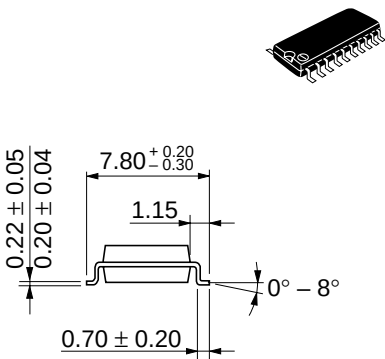
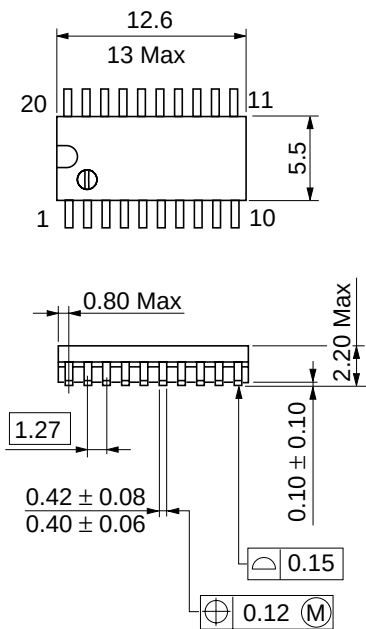
Note: C_L includes the probe and jig capacitance.

• Waveform



- Notes:
- 1. $t_r \leq 3\text{ ns}$, $t_f \leq 3\text{ ns}$
 - 2. Input waveform: $\text{PRR} \leq 1\text{ MHz}$, duty cycle 50%
 - 3. Waveform-A is for an output with internal conditions such that the output is low except when disabled by the output control.
 - 4. Waveform-B is for an output with internal conditions such that the output is high except when disabled by the output control.

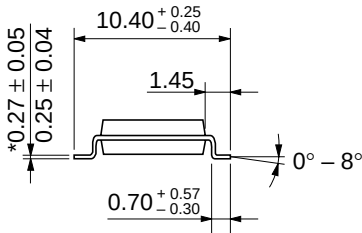
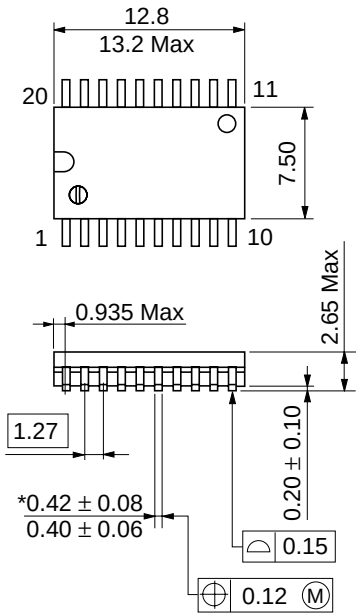
Package Dimensions



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

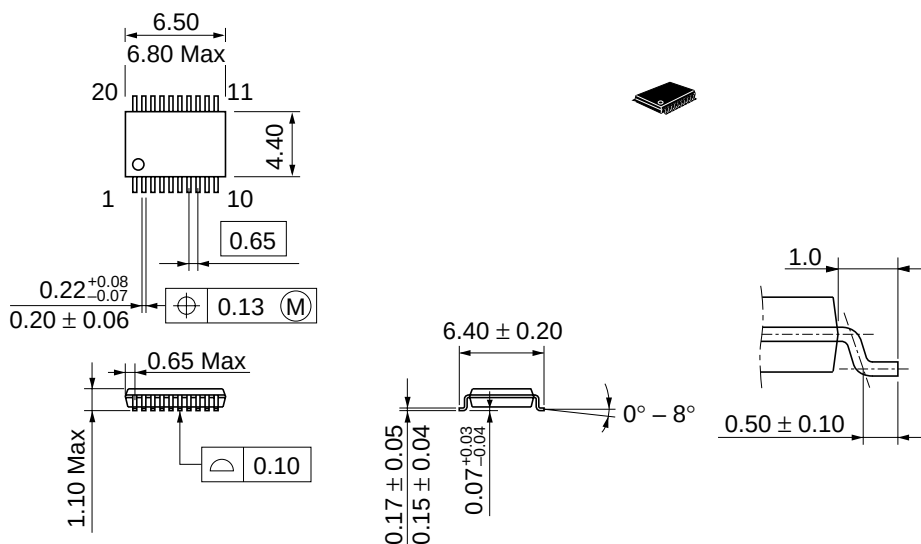
Dimension including the plating thickness
Base material dimension

Unit: mm



*Dimension including the plating thickness
Base material dimension

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



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

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

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HITACHI

Hitachi, Ltd.

Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

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For further information write to:

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Hitachi Asia Pte. Ltd. 16 Collyer Quay #20-00 Hitachi Tower Singapore 049318 Tel: 535-2100 Fax: 535-1533 Hitachi Asia Ltd. Taipei Branch Office 3F, Hung Kuo Building. No.167, Tun-Hwa North Road, Taipei (105) Tel: <886> (2) 2718-3666 Fax: <886> (2) 2718-8180
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Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: <852> (2) 735 9218
Fax: <852> (2) 730 0281
Telex: 40815 HITEC HX

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