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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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HD74LV541A

Octal Buffers / Drivers with 3-state Outputs



ADE-205-278 (Z)

1st Edition
April 1999

Description

The HD74LV541A has eight line drivers with three state outputs in a 20 pin package. When $\overline{\text{OE1}}$ and $\overline{\text{OE2}}$ 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

- $V_{\text{cc}} = 2.0 \text{ V}$ to 5.5 V operation
- All inputs V_{IH} (Max.) = 5.5 V (@ $V_{\text{cc}} = 0 \text{ V}$ to 5.5 V)
- All outputs V_{O} (Max.) = 5.5 V (@ $V_{\text{cc}} = 0 \text{ V}$)
- Typical V_{OL} ground bounce $< 0.8 \text{ V}$ (@ $V_{\text{cc}} = 3.3 \text{ V}$, $T_{\text{a}} = 25^{\circ}\text{C}$)
- Typical V_{OH} undershoot $> 2.3 \text{ V}$ (@ $V_{\text{cc}} = 3.3 \text{ V}$, $T_{\text{a}} = 25^{\circ}\text{C}$)
- Output current $\pm 8 \text{ mA}$ (@ $V_{\text{cc}} = 3.0 \text{ V}$ to 3.6 V), $\pm 16 \text{ mA}$ (@ $V_{\text{cc}} = 4.5 \text{ V}$ to 5.5 V)

Function Table

Inputs			Output Y
$\overline{\text{OE1}}$	$\overline{\text{OE2}}$	A	
L	L	L	L
L	L	H	H
H	X	X	Z
X	H	X	Z

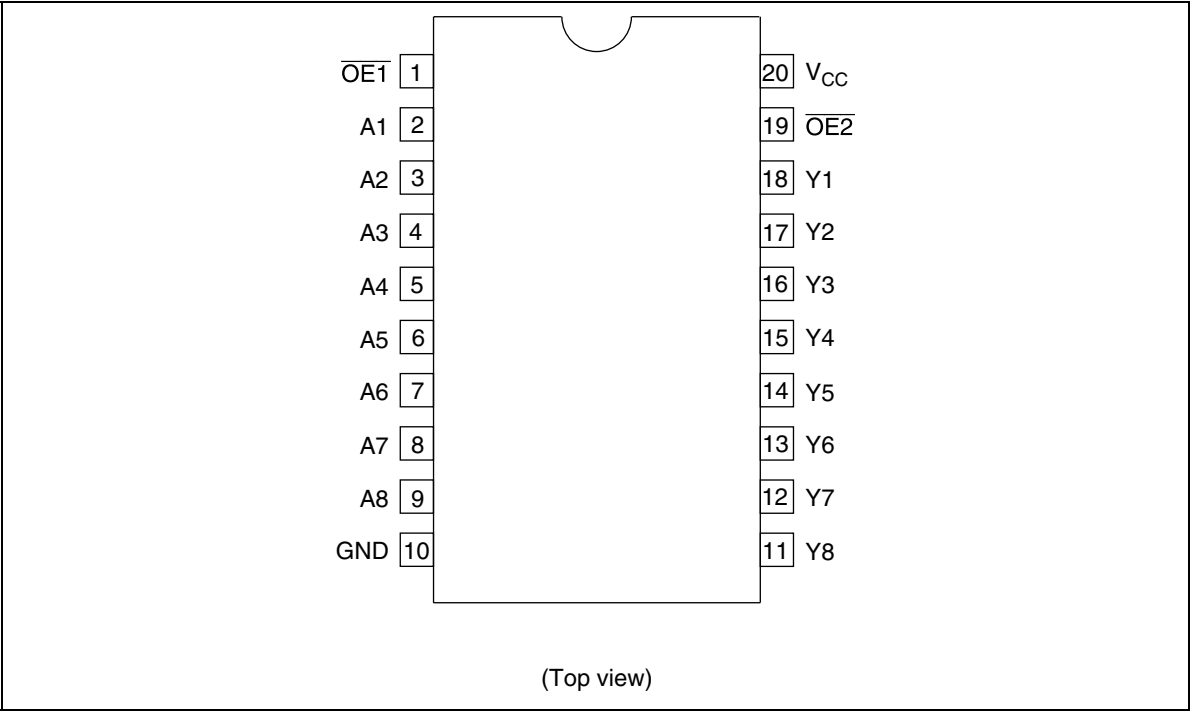
Note: H: High level

L: Low level

X: Immaterial

Z: High impedance

Pin Arrangement



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 $V_{CC} + 0.5$	V	Output: H or L
		−0.5 to 7.0		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 $T_a = 25^\circ\text{C}$ (in still air)* ³	P_T	835	mW	SOP
		757		TSSOP
Storage temperature	T_{stg}	−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.

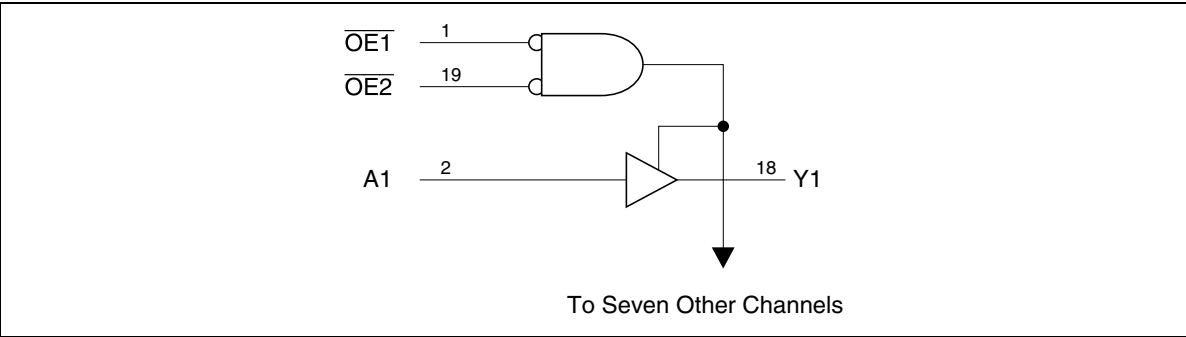
1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of 150°C.

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	$^{\circ}C$	

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

Logic Diagram



DC Electrical Characteristics

Ta = -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} × 0.7	—	—		
		3.0 to 3.6	V _{cc} × 0.7	—	—		
		4.5 to 5.5	V _{cc} × 0.7	—	—		
	V _{IL}	2.0	—	—	0.5		
		2.3 to 2.7	—	—	V _{cc} × 0.3		
		3.0 to 3.6	—	—	V _{cc} × 0.3		
		4.5 to 5.5	—	—	V _{cc} × 0.3		
Output voltage	V _{OH}	Min to Max	V _{cc} - 0.1	—	—	V	I _{OH} = -50 μA
		2.3	2.0	—	—		I _{OH} = -2 mA
		3.0	2.48	—	—		I _{OH} = -8 mA
		4.5	3.8	—	—		I _{OH} = -16 mA
	V _{OL}	Min to Max	—	—	0.1		I _{OL} = 50 μA
		2.3	—	—	0.4		I _{OL} = 2 mA
		3.0	—	—	0.44		I _{OL} = 8 mA
		4.5	—	—	0.55		I _{OL} = 16 mA
Input current	I _{IN}	0 to 5.5	—	—	±1	μA	V _{IN} = 5.5 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 V to 5.5 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 ± 0.2 V

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C			Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max					
Propa- gation delay time	t _{PLH}	—	7.3	11.3	1.0	13.5	ns	C _L = 15 pF		A	Y
	t _{PHL}										
		—	8.9	15.9	1.0	18.5		C _L = 50 pF			
Enable time	t _{ZH}	—	8.5	16.6	1.0	19.5	ns	C _L = 15 pF		OE	Y
	t _{ZL}										
		—	10.5	20.7	1.0	24.0		C _L = 50 pF			
Disable time	t _{HZ}	—	8.4	13.1	1.0	15.0	ns	C _L = 15 pF		OE	Y
	t _{LZ}										
		—	10.5	17.9	1.0	20.0		C _L = 50 pF			

V_{CC} = 3.3 ± 0.3 V

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C			Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max					
Propa- gation delay time	t _{PLH}	—	5.2	7.0	1.0	8.5	ns	C _L = 15 pF		A	Y
	t _{PHL}										
		—	6.5	10.5	1.0	12.0		C _L = 50 pF			
Enable time	t _{ZH}	—	6.1	10.5	1.0	12.5	ns	C _L = 15 pF		OE	Y
	t _{ZL}										
		—	8.0	14.0	1.0	16.0		C _L = 50 pF			
Disable time	t _{HZ}	—	5.8	11.0	1.0	12.0	ns	C _L = 15 pF		OE	Y
	t _{LZ}										
		—	7.0	15.4	1.0	17.5		C _L = 50 pF			

Switching Characteristics (cont)

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

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propa- gation delay time	t _{PLH}	—	3.9	5.0	1.0	6.0	ns	C _L = 15 pF	A	Y
	t _{PHL}	—	4.7	7.0	1.0	8.0		C _L = 50 pF		
Enable time	t _{ZH}	—	4.3	7.2	1.0	8.5	ns	C _L = 15 pF	$\overline{OE}$	Y
	t _{ZL}	—	6.3	9.2	1.0	10.5		C _L = 50 pF		
Disable time	t _{HZ}	—	3.9	7.5	1.0	8.0	ns	C _L = 15 pF	$\overline{OE}$	Y
	t _{LZ}	—	5.3	8.8	1.0	10.0		C _L = 50 pF		

Output-skew Characteristics

Item	Symbol	$V_{CC} = (V)$	$T_a = 25^{\circ}C$		$T_a = -40 \text{ to } 85^{\circ}C$		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

$C_L = 50 \text{ pF}$

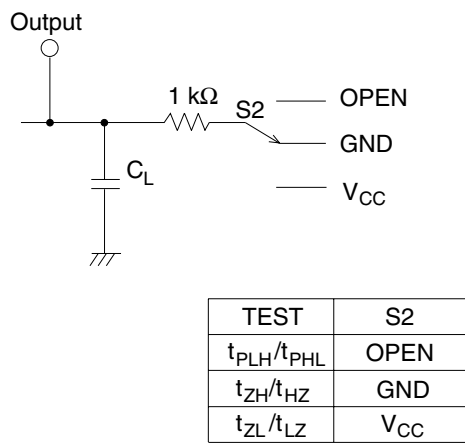
Item	Symbol	$V_{CC} = (V)$	$T_a = 25^{\circ}C$			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	C_{PD}	3.3	—	23.5	—	pF	$f = 10 \text{ MHz}$
		5.0	—	27.7	—		

Noise Characteristics

$C_L = 50 \text{ pF}$

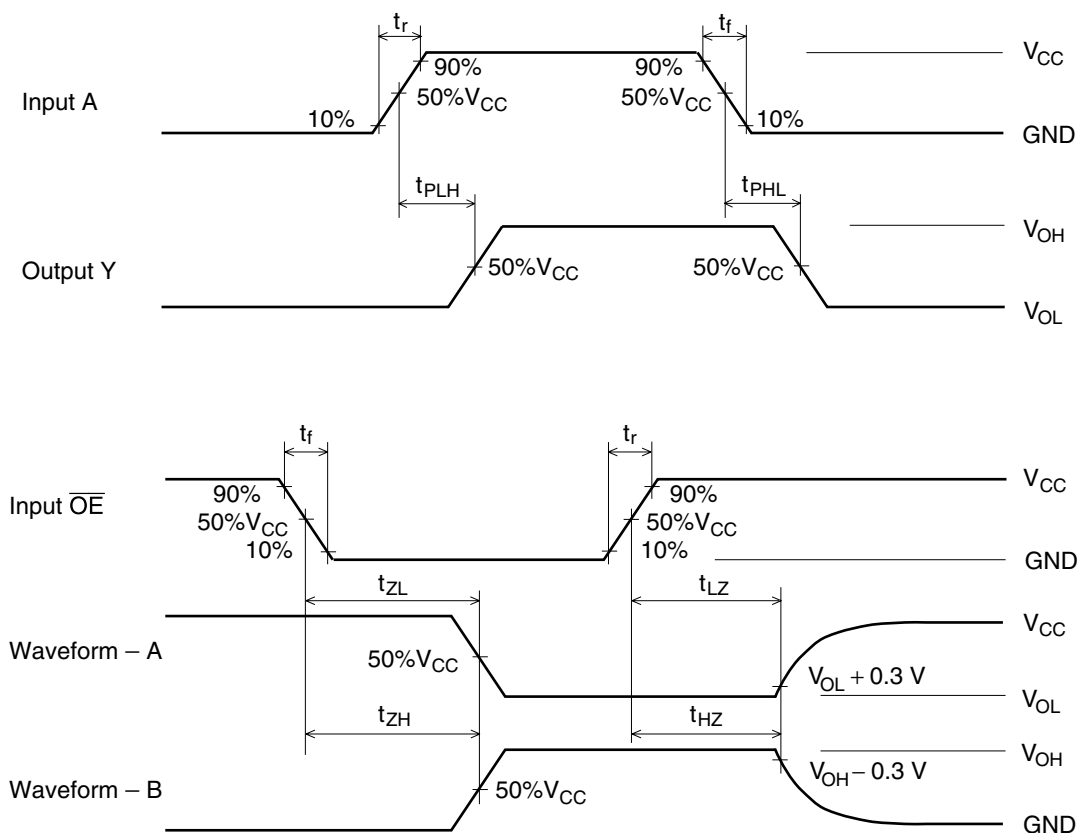
Item	Symbol	$V_{CC} = (V)$	$T_a = 25^{\circ}C$			Unit	Test Conditions
			Min	Typ	Max		
Quiet output, maximum dynamic V_{OL}	$V_{OL(P)}$	3.3	—	0.4	0.8	V	
Quiet output, minimum dynamic V_{OL}	$V_{OL(V)}$	3.3	—	−0.3	−0.8		
Quiet output, minimum dynamic V_{OH}	$V_{OH(V)}$	3.3	—	2.9	—		
High-level dynamic input voltage	$V_{IH(D)}$	3.3	2.31	—	—	V	
Low-level dynamic input voltage	$V_{IL(D)}$	3.3	—	—	0.99		

Test Circuit



Note: C_L includes the probe and jig capacitance.

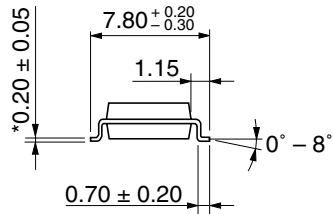
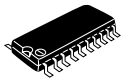
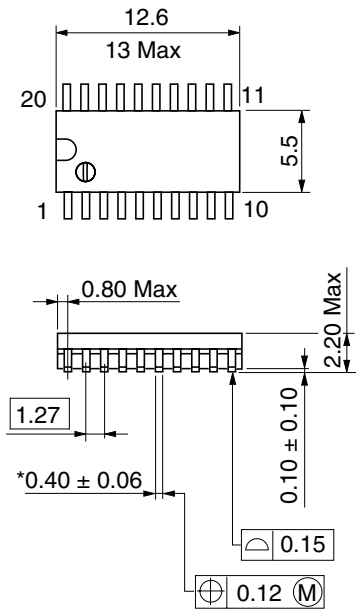
• Waveform



- Notes:
1. $t_r \leq 3\text{ ns}$, $t_f \leq 3\text{ ns}$
 2. Input waveform: $PRR \leq 1\text{ MHz}$, 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

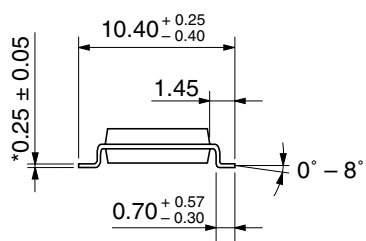
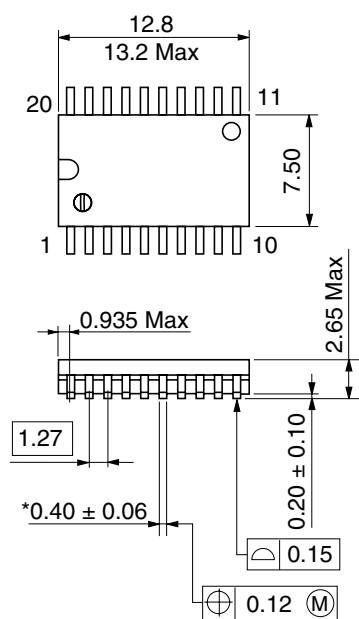
As of July, 2001
Unit: mm



*Pd plating

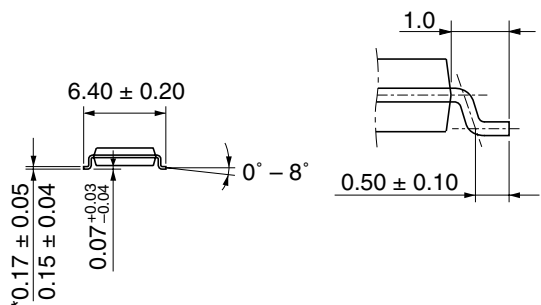
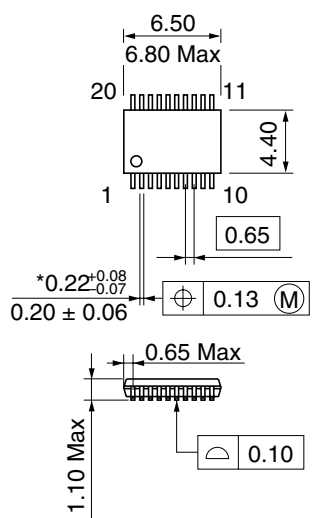
Hitachi Code	FP-20DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.31 g

As of July, 2001
Unit: mm



Hitachi Code	FP-20DBV
JEDEC	Conforms
JEITA	—
Mass (reference value)	0.52 g

As of July, 2001
Unit: mm



Hitachi Code	TTP-20DA
JEDEC	—
JEITA	—
Mass (reference value)	0.07 g

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