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

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HD74LV540A

Octal Inverted Buffers / Drivers with 3-state Outputs

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 V to 5.5 V operation
- All inputs V_{IH} (Max.) = 5.5 V (@V_{CC} = 0 V to 5.5 V)
- All outputs V_O (Max.) = 5.5 V (@V_{CC} = 0 V)
- Typical V_{OL} ground bounce < 0.8 V (@V_{CC} = 3.3 V, Ta = 25°C)
- Typical V_{OH} undershoot > 2.3 V (@V_{CC} = 3.3 V, Ta = 25°C)
- Output current ±8 mA (@V_{CC} = 3.0 V to 3.6 V), ±16 mA (@V_{CC} = 4.5 V to 5.5 V)

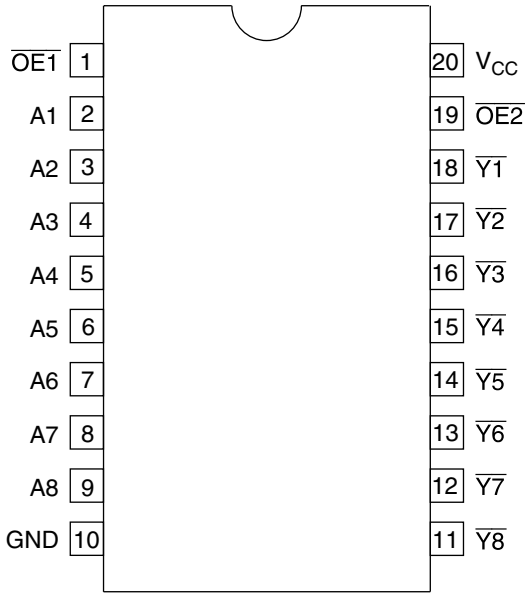
Function Table

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	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 Ta = 25°C (in still air)*[3]	P_T	835	mW	SOP
		757		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.

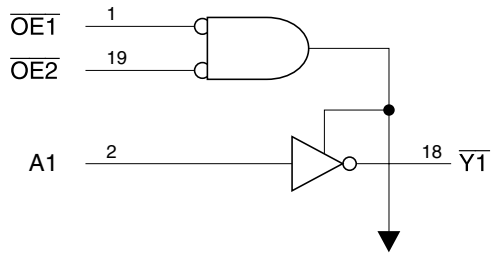
1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of 150°C.

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 V
		—	–2	mA	V_{CC} = 2.3 to 2.7 V
		—	–8		V_{CC} = 3.0 to 3.6 V
		—	–16		V_{CC} = 4.5 to 5.5 V
	I_{OL}	—	50	µA	V_{CC} = 2.0 V
		—	2	mA	V_{CC} = 2.3 to 2.7 V
		—	8		V_{CC} = 3.0 to 3.6 V
		—	16		V_{CC} = 4.5 to 5.5 V
Input transition rise or fall rate	Δt /Δv	0	200	ns/V	V_{CC} = 2.3 to 2.7 V
		0	100		V_{CC} = 3.0 to 3.6 V
		0	20		V_{CC} = 4.5 to 5.5 V
Operating free-air temperature	Ta	–40	85	°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	$V_{cc} \times 0.7$	—	—		
		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 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

$V_{CC} = 2.5 \pm 0.2$ 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} t_{PHL}	—	7.4	12.0	1.0	14.5	ns	C_L = 15 pF	A	$\overline{Y}$
		—	9.3	16.8	1.0	18.5		C_L = 50 pF		
Enable time	t_{ZH} t_{ZL}	—	8.2	17.4	1.0	21.0	ns	C_L = 15 pF	$\overline{OE}$	$\overline{Y}$
		—	9.6	22.2	1.0	25.5		C_L = 50 pF		
Disable time	t_{HZ} t_{LZ}	—	7.5	16.0	1.0	19.0	ns	C_L = 15 pF	$\overline{OE}$	$\overline{Y}$
		—	10.5	22.3	1.0	25.5		C_L = 50 pF		

$V_{CC} = 3.3 \pm 0.3$ 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} t_{PHL}	—	5.3	7.0	1.0	8.5	ns	C_L = 15 pF	A	$\overline{Y}$
		—	6.8	10.5	1.0	12.0		C_L = 50 pF		
Enable time	t_{ZH} t_{ZL}	—	6.2	10.5	1.0	12.5	ns	C_L = 15 pF	$\overline{OE}$	$\overline{Y}$
		—	7.6	14.0	1.0	16.0		C_L = 50 pF		
Disable time	t_{HZ} t_{LZ}	—	5.3	10.5	1.0	12.5	ns	C_L = 15 pF	$\overline{OE}$	$\overline{Y}$
		—	7.0	15.4	1.0	17.5		C_L = 50 pF		

Switching Characteristics (cont)

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

Item	Symbol	Ta = 25°C Min	Typ	Max	Ta = –40 to 85°C Min	Max	Unit	Test Conditions	FROM (Input)	TO (Output)
Propagation delay time	t_{PLH} t_{PHL}	—	3.8	5.0	1.0	6.0	ns	C_L = 15 pF	A	$\overline{Y}$
		—	5.0	7.0	1.0	8.0		C_L = 50 pF		
Enable time	t_{ZH} t_{ZL}	—	4.6	7.2	1.0	8.5	ns	C_L = 15 pF	$\overline{OE}$	$\overline{Y}$
		—	5.8	9.2	1.0	10.5		C_L = 50 pF		
Disable time	t_{HZ} t_{LZ}	—	3.6	6.8	1.0	8.0	ns	C_L = 15 pF	$\overline{OE}$	$\overline{Y}$
		—	5.3	8.8	1.0	10.0		C_L = 50 pF		

Output-skew Characteristics

			Ta = 25°C		Ta = –40 to 85°C		
Item	**Symbol**	**V_{cc} = (V)**	**Min**	**Max**	**Min**	**Max**	**Unit**
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

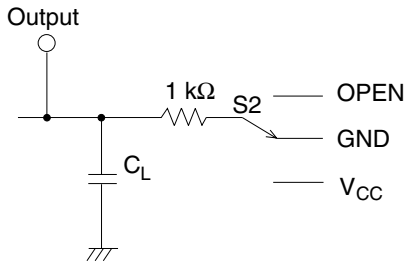
			Ta = 25°C				
Item	**Symbol**	**V_{cc} = (V)**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions**
Power dissipation capacitance	C_{PD}	3.3	—	23.0	—	pF	f = 10 MHz
		5.0	—	27.5	—		

Noise Characteristics

C_L = 50 pF

			Ta = 25°C				
Item	**Symbol**	**V_{cc} = (V)**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions**
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		

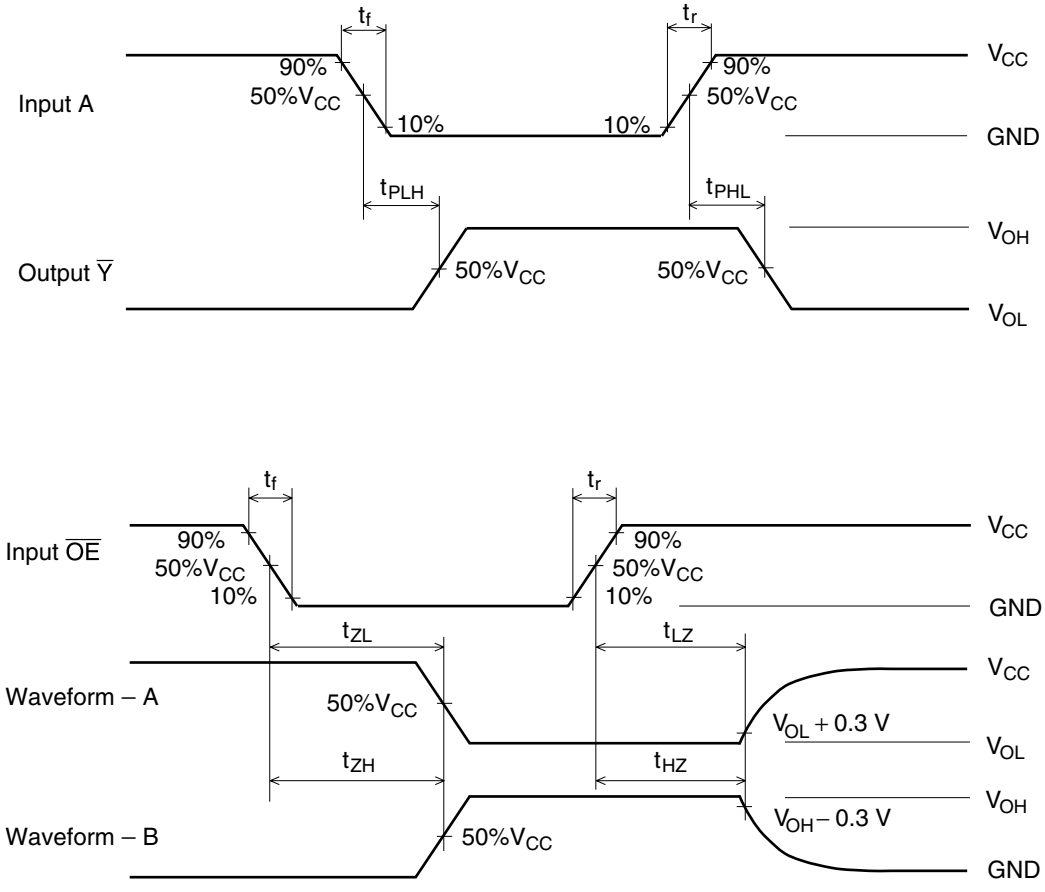
Test Circuit



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

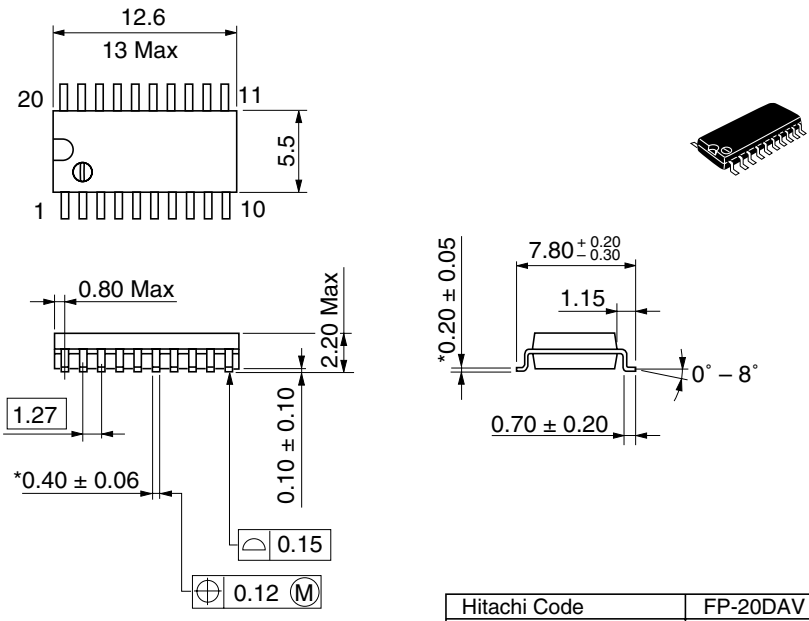


Notes: 1. $t_r \leq 3$ ns, $t_f \leq 3$ ns
2. Input waveform: PRR ≤ 1 MHZ, duty cycle 50%
3. Waveform-A is for an output with internal conditions such that the output is low except when disabled by the output control.
4. Waveform-B is for an output with internal conditions such that the output is high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

Package Dimensions

As of July, 2001

Unit: mm

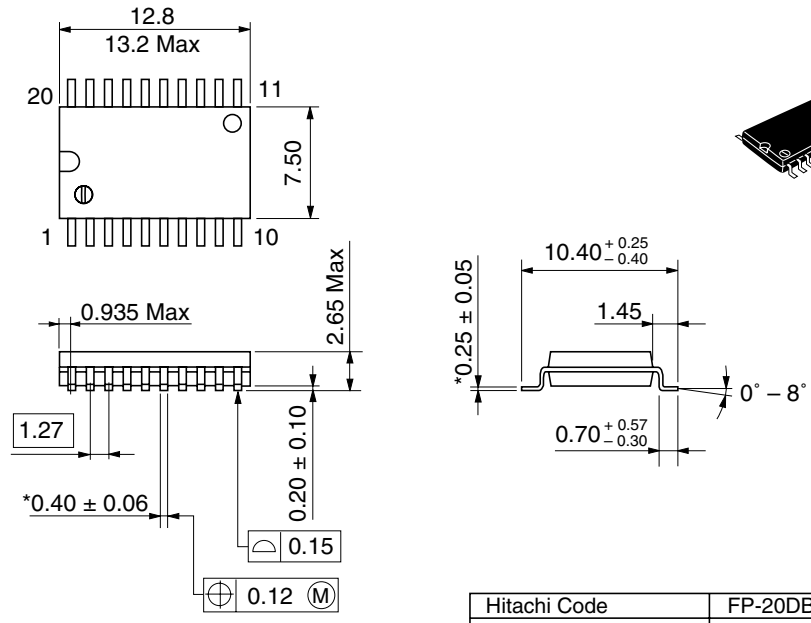


*Pd plating

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

As of July, 2001

Unit: mm

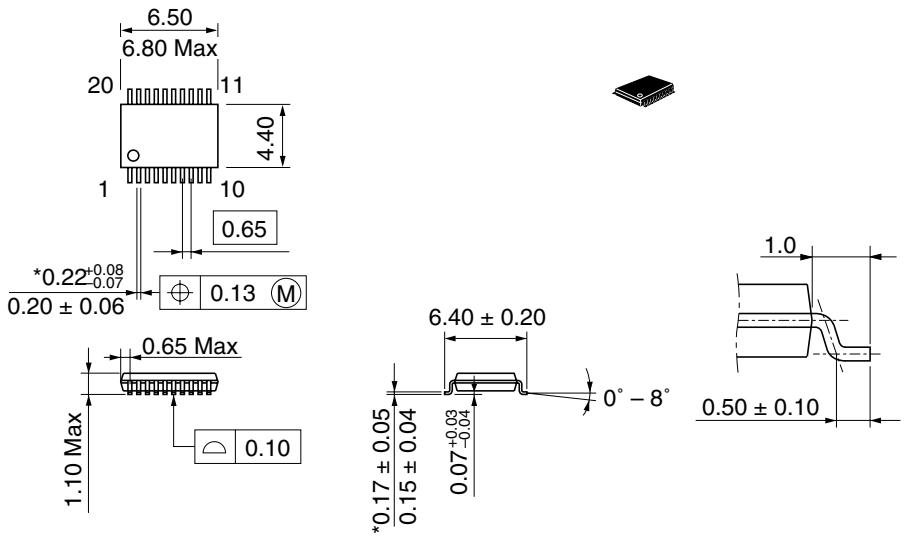


*Pd plating

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

As of July, 2001

Unit: mm



*Dimension including the plating thickness
Base material dimension

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

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