

HD74LV02A

Quad. 2-input NOR Gates

HITACHI

ADE-205-241 (Z)
1st Edition
March 1999

Description

The HD74LV02A has four two-input NOR gates in a 14-pin package. Low-voltage and high-speed operation is suitable for the 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 $\pm 6\text{ mA}$ (@ $V_{CC} = 3.0\text{ V}$ to 3.6 V), $\pm 12\text{ mA}$ (@ $V_{CC} = 4.5\text{ V}$ to 5.5 V)

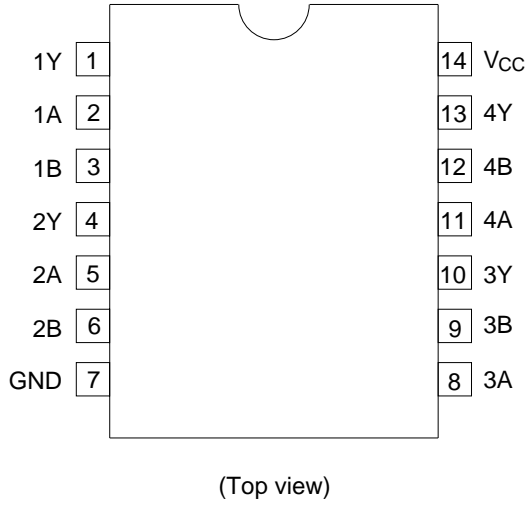
Function Table

Inputs

| A | B | Output Y |
|---|---|----------|
| H | X | L |
| X | H | L |
| L | L | H |

Note: H: High level
L: Low level
X: Immaterial

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 $V_{CC} + 0.5$ -0.5 to 7.0 | V | Output: H or L V_{CC} : OFF |
| 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 | ± 25 | mA | $V_O = 0$ to V_{CC} |
| Continuous current through V_{CC} or GND | I_{CC} or I_{GND} | ± 50 | mA | |
| Maximum power dissipation at $T_a = 25^\circ\text{C}$ (in still air)* ³ | P_T | 785 | mW | SOP |
| | | 500 | | TSSOP |
| Storage temperature | T_{stg} | -65 to 150 | $^\circ\text{C}$ | |

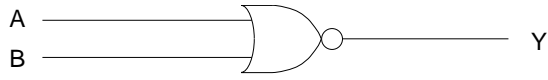
Notes: The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

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 | |
| Output current | I_{OH} | — | -50 | μA | $V_{CC} = 2.0 \text{ V}$ |
| | | — | -2 | mA | $V_{CC} = 2.3 \text{ to } 2.7 \text{ V}$ |
| | | — | -6 | | $V_{CC} = 3.0 \text{ to } 3.6 \text{ V}$ |
| | | — | -12 | | $V_{CC} = 4.5 \text{ to } 5.5 \text{ V}$ |
| | I_{OL} | — | 50 | μA | $V_{CC} = 2.0 \text{ V}$ |
| | | — | 2 | mA | $V_{CC} = 2.3 \text{ to } 2.7 \text{ V}$ |
| | | — | 6 | | $V_{CC} = 3.0 \text{ to } 3.6 \text{ V}$ |
| | | — | 12 | | $V_{CC} = 4.5 \text{ to } 5.5 \text{ V}$ |
| 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 | $^{\circ}\text{C}$ | |

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 | — | — | | $I_{OH} = -6 \text{ mA}$ |
| | | 4.5 | 3.8 | — | — | | $I_{OH} = -12 \text{ mA}$ |
| | 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 | | $I_{OL} = 6 \text{ mA}$ |
| | | 4.5 | — | — | 0.55 | | $I_{OL} = 12 \text{ mA}$ |
| Input current | I_{IN} | 0 to 5.5 | — | — | ± 1 | μA | $V_{IN} = 5.5 \text{ V}$ 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 | $V_O = 5.5 \text{ V}$ |
| Input capacitance | C_{IN} | 3.3 | — | 1.6 | — | pF | $V_I = V_{CC}$ or GND |

Note: For the values of Min or Max, use the appropriate values under the recommended operating conditions.

Switching Characteristics

- $V_{CC} = 2.5 \pm 0.2 \text{ V}$

| Item | Symbol | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | Test Conditions | FROM (Input) | TO (Output) |
|------------------------|-----------|-----------|------|------|------------------|------|------|-----------------------|--------------|-------------|
| | | Min | Typ | Max | Min | Max | | | | |
| Propagation delay time | t_{PLH} | — | 8.3 | 12.4 | 1.0 | 15.0 | ns | $C_L = 15 \text{ pF}$ | A or B | Y |
| | t_{PHL} | — | 11.0 | 16.1 | 1.0 | 19.0 | | $C_L = 50 \text{ pF}$ | | |

- $V_{CC} = 3.3 \pm 0.3 \text{ V}$

| Item | Symbol | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | Test Conditions | FROM (Input) | TO (Output) |
|------------------------|-----------|-----------|-----|------|------------------|------|------|-----------------------|--------------|-------------|
| | | Min | Typ | Max | Min | Max | | | | |
| Propagation delay time | t_{PLH} | — | 5.6 | 7.9 | 1.0 | 9.5 | ns | $C_L = 15 \text{ pF}$ | A or B | Y |
| | t_{PHL} | — | 7.6 | 11.4 | 1.0 | 13.0 | | $C_L = 50 \text{ pF}$ | | |

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

| Item | Symbol | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | Test Conditions | FROM (Input) | TO (Output) |
|------------------------|-----------|-----------|-----|-----|------------------|-----|------|-----------------------|--------------|-------------|
| | | Min | Typ | Max | Min | Max | | | | |
| Propagation delay time | t_{PLH} | — | 3.9 | 5.5 | 1.0 | 6.5 | ns | $C_L = 15 \text{ pF}$ | A or B | Y |
| | t_{PHL} | — | 5.3 | 7.5 | 1.0 | 8.5 | | $C_L = 50 \text{ pF}$ | | |

Operating Characteristics

- $C_L = 50 \text{ pF}$

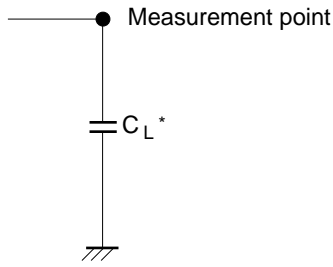
| Item | Symbol | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | | Unit | Test Conditions |
|-------------------------------|----------|--------------|--------------------------|------|-----|------|-----------------|
| | | | Min | Typ | Max | | |
| Power dissipation capacitance | C_{PD} | 3.3 | — | 8.9 | — | pF | f = 10 MHz |
| | | 5.0 | — | 10.3 | — | | |

Noise Characteristics

- $C_L = 50 \text{ pF}$

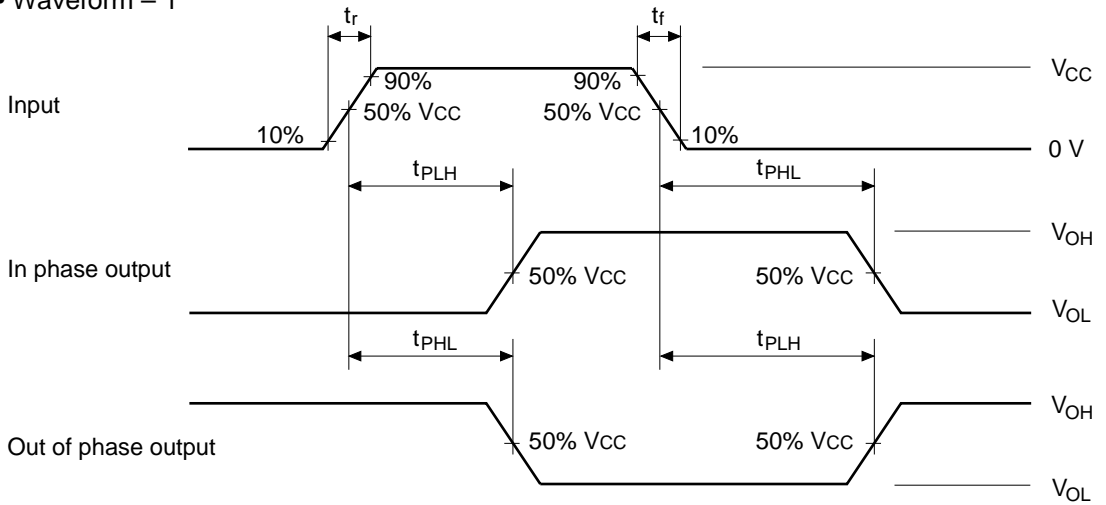
| Item | Symbol | V_{CC} (V) | $T_a = 25^\circ\text{C}$ | | | Unit | Test Conditions |
|--|-------------|--------------|--------------------------|------|------|------|-----------------|
| | | | Min | Typ | Max | | |
| Quiet output, maximum dynamic V_{OL} | $V_{OL(P)}$ | 3.3 | — | 0.2 | 0.8 | V | |
| Quiet output, minimum dynamic V_{OL} | $V_{OL(V)}$ | 3.3 | — | -0.1 | -0.8 | | |
| Quiet output, minimum dynamic V_{OH} | $V_{OH(V)}$ | 3.3 | — | 3.2 | — | | |
| High-level dynamic input voltage | $V_{IH(D)}$ | 3.3 | 2.31 | — | — | V | |
| Low level dynamic voltage | $V_{IL(D)}$ | 3.3 | — | — | 0.99 | | |

Test Circuit



Note: C_L includes the probe and jig capacitance.

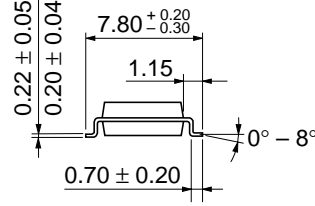
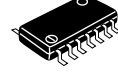
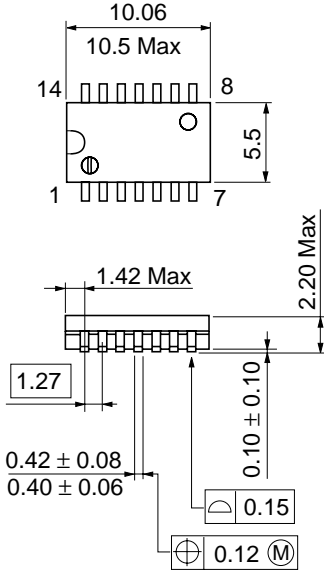
• Waveform – 1



- Notes: 1. Input waveform: $PRR \leq 1 \text{ MHz}$, $Z_o = 50 \Omega$, $t_r \leq 3 \text{ ns}$, $t_f \leq 3 \text{ ns}$
- 2. The output are measured one at a time with one transition per measurement.

Package Dimensions

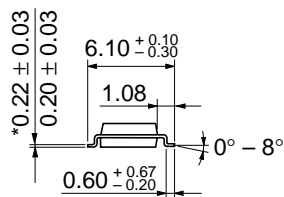
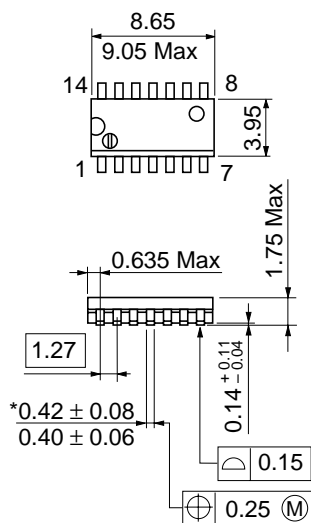
Unit: mm



Dimension including the plating thickness
Base material dimension

| | |
|--------------------------|----------|
| Hitachi Code | FP-14DA |
| JEDEC | — |
| EIAJ | Conforms |
| Weight (reference value) | 0.23 g |

Unit: mm

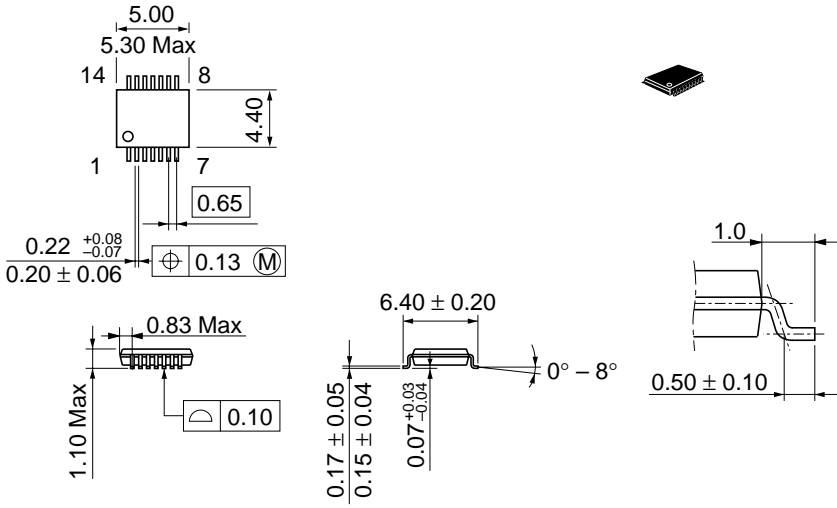


*Dimension including the plating thickness
Base material dimension

| | |
|--------------------------|----------|
| Hitachi Code | FP-14DN |
| JEDEC | Conforms |
| EIAJ | Conforms |
| Weight (reference value) | 0.13 g |

HD74LV02A

Unit: mm



Dimension including the plating thickness
Base material dimension

| | |
|--------------------------|---------|
| Hitachi Code | TTP-14D |
| JEDEC | — |
| EIAJ | — |
| Weight (reference value) | 0.05 g |

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