

# HD74LV139A

## Dual 2-to-4-line Decoders / Demultiplexers

REJ03D0385-0100

Rev.1.00

Aug. 24, 2004

### Description

The HD74LV139A has two independent two-to-four-line decoders each with a single active low enable input in a 16 pin package. Data on the select inputs cause one of the four normally high outputs to go low. 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  $V_O(\text{Max.}) = 5.5\text{ V} (@V_{CC} = 0\text{ V})$
- 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  $> 2.3\text{ V} (@V_{CC} = 3.3\text{ V}, T_a = 25^\circ\text{C})$
- High output current  $\pm 6\text{ mA} (@V_{CC} = 3.0\text{ V to }3.6\text{ V}), \pm 12\text{ mA} (@V_{CC} = 4.5\text{ V to }5.5\text{ V})$
- Ordering Information

| Part Name      | Package Type       | Package Code | Package Abbreviation | Taping Abbreviation (Quantity) |
|----------------|--------------------|--------------|----------------------|--------------------------------|
| HD74LV139AFPEL | SOP-16 pin (JEITA) | FP-16DAV     | FP                   | EL (2,000 pcs/reel)            |
| HD74LV139ATELL | TSSOP-16 pin       | TTP-16DAV    | T                    | ELL (2,000 pcs/reel)           |

Note: Please consult the sales office for the above package availability.

### Function Table

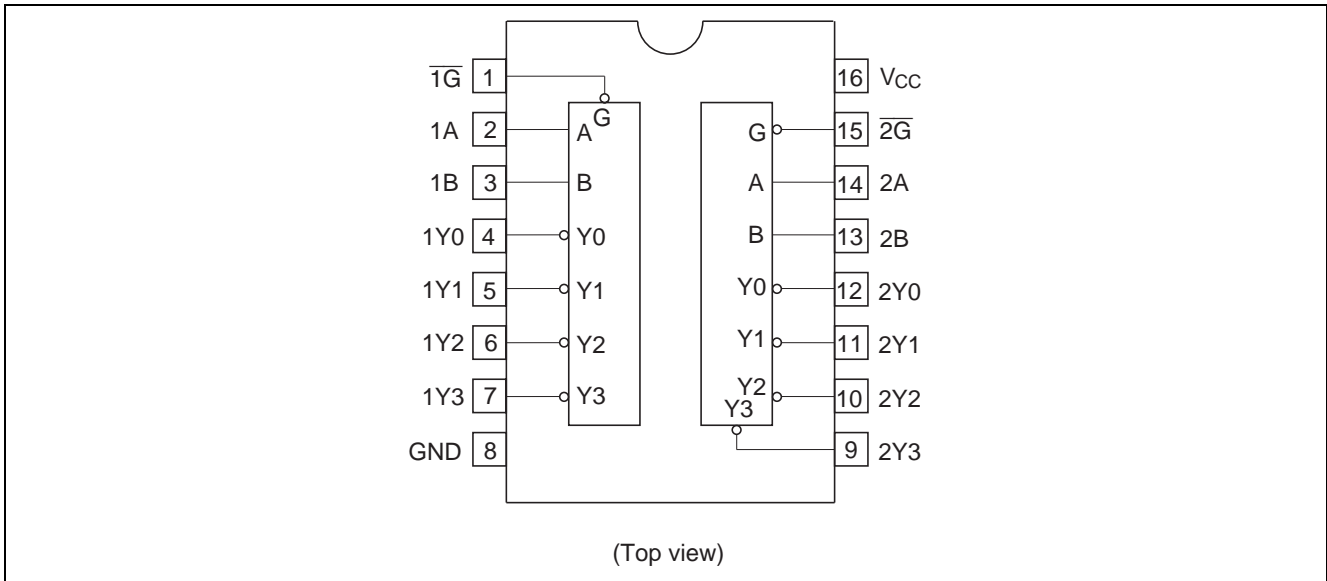
| Input     |        |   | Outputs |    |    |    |
|-----------|--------|---|---------|----|----|----|
| Enable    | Select |   |         |    |    |    |
| $\bar{G}$ | B      | A | Y0      | Y1 | Y2 | Y3 |
| H         | X      | X | H       | H  | H  | H  |
| L         | L      | L | L       | H  | H  | H  |
| L         | L      | H | H       | L  | H  | H  |
| L         | H      | L | H       | H  | L  | H  |
| L         | H      | H | H       | H  | H  | L  |

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* <sup>1</sup>  | $V_I$                 | -0.5 to 7.0            | V                |                             |
| Output voltage range* <sup>1, 2</sup>  | $V_O$                 | -0.5 to $V_{CC} + 0.5$ | V                | Output: H or L              |
|  |                       | -0.5 to 7.0            |                  | $V_{CC}$ : OFF              |
| Input clamp current  | $I_{IK}$              | -20                    | mA               | $V_I < 0$                   |
| Output clamp current   | $I_{OK}$              | $\pm 50$               | mA               | $V_O < 0$ or $V_O > V_{CC}$ |
| Continuous output current  | $I_O$                 | $\pm 25$               | mA               | $V_O = 0$ to $V_{CC}$       |
| Continuous current through $V_{CC}$ or GND   | $I_{CC}$ or $I_{GND}$ | $\pm 50$               | mA               |                             |
| Maximum power dissipation at $T_a = 25^\circ\text{C}$ (in still air)* <sup>3</sup> | $P_T$                 | 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      | $\mu A$     | $V_{CC} = 2.0 V$                 |
|                                    |                       | —   | -2       | mA          | $V_{CC} = 2.3 \text{ to } 2.7 V$ |
|                                    |                       | —   | -6       |             | $V_{CC} = 3.0 \text{ to } 3.6 V$ |
|                                    |                       | —   | -12      |             | $V_{CC} = 4.5 \text{ to } 5.5 V$ |
|                                    | $I_{OL}$              | —   | 50       | $\mu A$     | $V_{CC} = 2.0 V$                 |
|                                    |                       | —   | 2        | mA          | $V_{CC} = 2.3 \text{ to } 2.7 V$ |
|                                    |                       | —   | 6        |             | $V_{CC} = 3.0 \text{ to } 3.6 V$ |
|                                    |                       | —   | 12       |             | $V_{CC} = 4.5 \text{ to } 5.5 V$ |
| Input transition rise or fall rate | $\Delta t / \Delta v$ | 0   | 200      | ns/V        | $V_{CC} = 2.3 \text{ to } 2.7 V$ |
|                                    |                       | 0   | 100      |             | $V_{CC} = 3.0 \text{ to } 3.6 V$ |
|                                    |                       | 0   | 20       |             | $V_{CC} = 4.5 \text{ to } 5.5 V$ |
| Operating free-air temperature     | $T_a$                 | -40 | 85       | $^{\circ}C$ |                                  |

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

### DC Electrical Characteristics

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

| 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       | $I_{OH} = -50 \mu A$                          |
|                          |           | 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                 |         | $I_{OL} = 50 \mu A$                           |
|                          |           | 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       | —                   | —   | $\pm 1$             | $\mu A$ | $V_{IN} = 5.5 V \text{ or } GND$              |
| Quiescent supply current | $I_{CC}$  | 5.5            | —                   | —   | 20                  | $\mu A$ | $V_{IN} = V_{CC} \text{ or } GND, I_O = 0$    |
| Output leakage current   | $I_{OFF}$ | 0              | —                   | —   | 5                   | $\mu A$ | $V_I \text{ or } V_O = 0 V \text{ to } 5.5 V$ |
| Input capacitance        | $C_{IN}$  | 3.3            | —                   | 3.3 | —                   | pF      | $V_I = V_{CC} \text{ or } GND$                |

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

## Switching Characteristics

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

| 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 | $t_{PLH}/t_{PHL}$ | —         | 7.5  | 17.6 | 1.0              | 21.0 | ns   | $C_L = 15 \text{ pF}$ | A or B         | Y           |
|                        |                   | —         | 10.5 | 22.5 | 1.0              | 26.5 |      | $C_L = 50 \text{ pF}$ |                |             |
|                        |                   | —         | 7.5  | 15.8 | 1.0              | 19.0 |      | $C_L = 15 \text{ pF}$ | $\overline{G}$ |             |
|                        |                   | —         | 10.0 | 20.2 | 1.0              | 24.0 |      | $C_L = 50 \text{ pF}$ |                |             |

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

| 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 | $t_{PLH}/t_{PHL}$ | —         | 5.5 | 11.0 | 1.0              | 13.0 | ns   | $C_L = 15 \text{ pF}$ | A or B         | Y           |
|                        |                   | —         | 7.5 | 14.5 | 1.0              | 16.5 |      | $C_L = 50 \text{ pF}$ |                |             |
|                        |                   | —         | 5.5 | 9.2  | 1.0              | 11.0 |      | $C_L = 15 \text{ pF}$ | $\overline{G}$ |             |
|                        |                   | —         | 7.0 | 12.7 | 1.0              | 14.5 |      | $C_L = 50 \text{ pF}$ |                |             |

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

| 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 | $t_{PLH}/t_{PHL}$ | —         | 4.0 | 7.2 | 1.0              | 8.5  | ns   | $C_L = 15 \text{ pF}$ | A or B         | Y           |
|                        |                   | —         | 5.5 | 9.2 | 1.0              | 10.5 |      | $C_L = 50 \text{ pF}$ |                |             |
|                        |                   | —         | 4.0 | 6.3 | 1.0              | 7.5  |      | $C_L = 15 \text{ pF}$ | $\overline{G}$ |             |
|                        |                   | —         | 5.5 | 8.3 | 1.0              | 9.5  |      | $C_L = 50 \text{ pF}$ |                |             |

## Operating Characteristics

$C_L = 50 \text{ pF}$

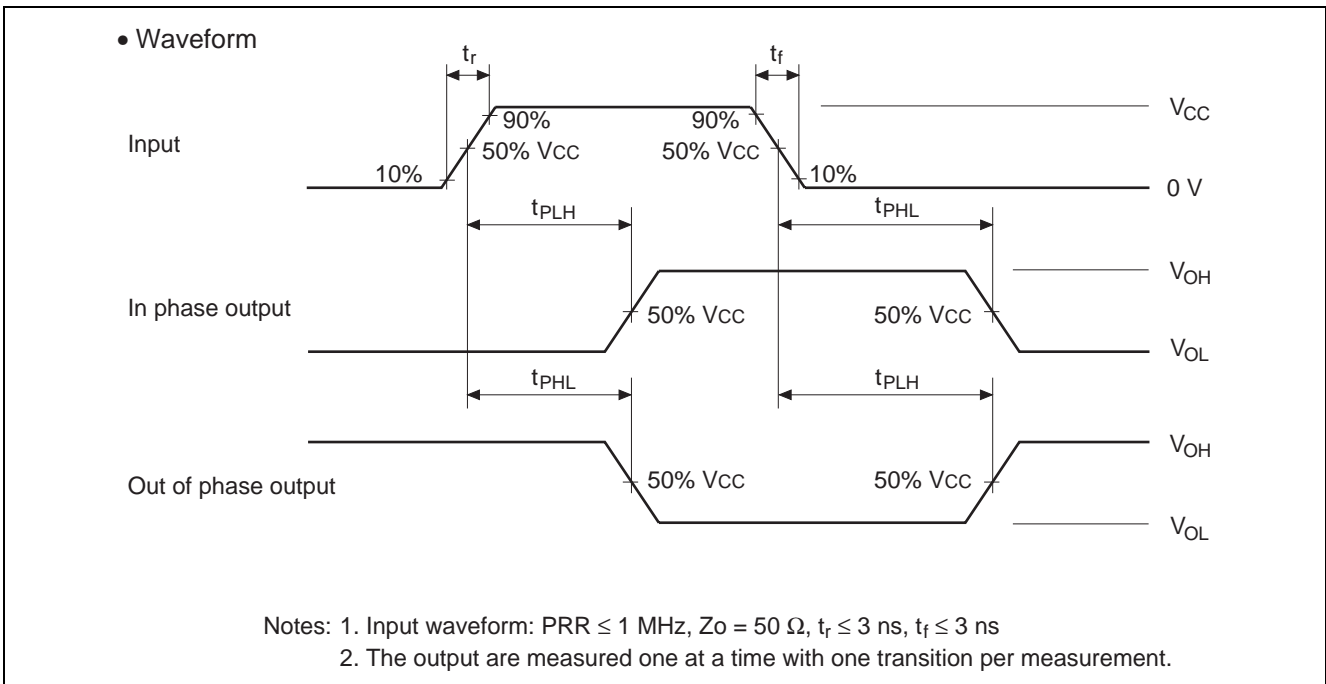
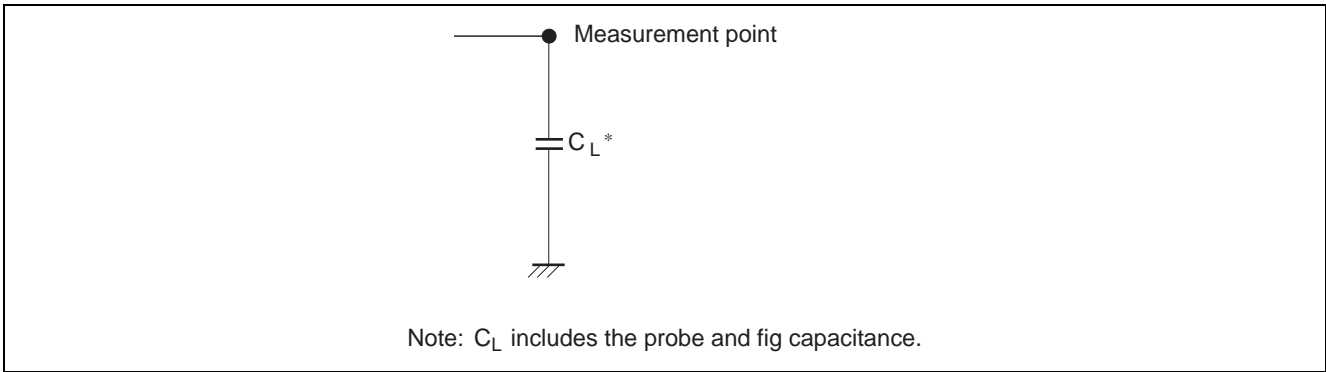
| Item                          | Symbol   | $V_{CC} \text{ (V)}$ | Ta = 25°C |      |     | Unit | Test Conditions |
|-------------------------------|----------|----------------------|-----------|------|-----|------|-----------------|
|                               |          |                      | Min       | Typ  | Max |      |                 |
| Power dissipation capacitance | $C_{PD}$ | 3.3                  | —         | 17.3 | —   | pF   | f = 10 MHz      |
|                               |          | 5.0                  | —         | 18.2 | —   |      |                 |

## Noise Characteristics

$C_L = 50 \text{ pF}$

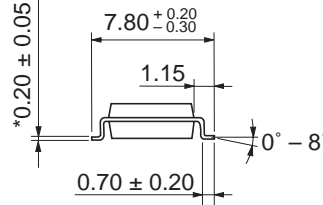
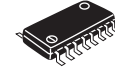
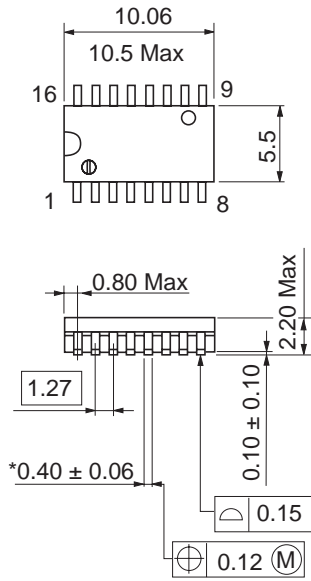
| Item                                   | Symbol      | $V_{CC} \text{ (V)}$ | Ta = 25°C |      |      | Unit | Test Conditions |
|--|-------------|----------------------|-----------|------|------|------|-----------------|
|  |             |                      | Min       | Typ  | Max  |      |                 |
| Quiet output, maximum dynamic $V_{OL}$ | $V_{OL(P)}$ | 3.3                  | —         | 0.3  | 0.8  | V    |                 |
| Quiet output, minimum dynamic $V_{OL}$ | $V_{OL(V)}$ | 3.3                  | —         | -0.2 | -0.8 | V    |                 |
| Quiet output, minimum dynamic $V_{OH}$ | $V_{OH(V)}$ | 3.3                  | —         | 3.0  | —    | V    |                 |
| 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 | V    |                 |

Test Circuit



Package Dimensions

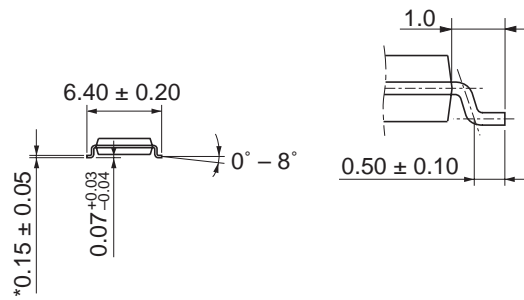
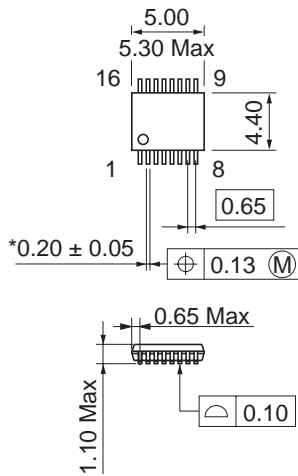
As of January, 2003  
Unit: mm



\*Ni/Pd/Au plating

|                        |          |
|------------------------|----------|
| Package Code           | FP-16DAV |
| JEDEC                  | —        |
| JEITA                  | Conforms |
| Mass (reference value) | 0.24 g   |

As of January, 2003  
Unit: mm



\*Ni/Pd/Au plating

|                        |           |
|------------------------|-----------|
| Package Code           | TTP-16DAV |
| JEDEC                  | —         |
| JEITA                  | —         |
| Mass (reference value) | 0.05 g    |

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