

# RD74LVC04B

## Hex Inverters

REJ03D0217-0100Z

Rev.1.00

Apr.08.2004

### Description

The RD74LVC04B has six inverters in a 14-pin package. 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

- $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$
- All inputs  $V_{IH} (\text{Max.}) = 5.5 \text{ V} (@V_{CC} = 0 \text{ V to } 5.5 \text{ V})$
- 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  $> 2.0 \text{ V} (@V_{CC} = 3.3 \text{ V}, T_a = 25^\circ\text{C})$
- High output current
  - $\pm 4 \text{ mA} (@V_{CC} = 1.65 \text{ V})$
  - $\pm 8 \text{ mA} (@V_{CC} = 2.3 \text{ V})$
  - $\pm 12 \text{ mA} (@V_{CC} = 2.7 \text{ V})$
  - $\pm 24 \text{ mA} (@V_{CC} = 3.0 \text{ V to } 5.5 \text{ V})$

### Ordering Information

| Part Name      | Package Type       | Package Code | Package Abbreviation | Taping Abbreviation (Quantity) |
|----------------|--------------------|--------------|----------------------|--------------------------------|
| RD74LVC04BFPEL | SOP-14 pin (JEITA) | FP-14DAV     | FP                   | EL (2,000 pcs/reel)            |
| RD74LVC04BTELL | TSSOP-14 pin       | TTP-14DV     | T                    | ELL (2,000 pcs/reel)           |

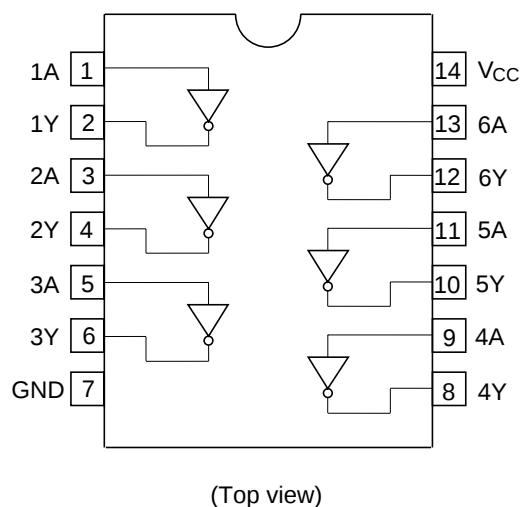
### Function Table

| Input A | Output Y |
|---------|----------|
| H       | L        |
| L       | H        |

H : High level

L : Low level

## Pin Arrangement



## Absolute Maximum Ratings

| Item                         | Symbol                | Ratings                | Unit | Conditions                    |
|------------------------------|-----------------------|------------------------|------|-------------------------------|
| Supply voltage range         | $V_{CC}$              | -0.5 to 7.0            | V    |                               |
| Input diode current          | $I_{IK}$              | -50                    | mA   | $V_I = -0.5\text{ V}$         |
| Input voltage                | $V_I$                 | -0.5 to 7.0            | V    |                               |
| Output diode current         | $I_{OK}$              | -50                    | mA   | $V_O = -0.5\text{ V}$         |
|                              |                       | 50                     | mA   | $V_O = V_{CC} + 0.5\text{ V}$ |
| Output voltage               | $V_O$                 | -0.5 to $V_{CC} + 0.5$ | V    |                               |
| Output current               | $I_O$                 | $\pm 50$               | mA   |                               |
| $V_{CC}$ , GND current / pin | $I_{CC}$ or $I_{GND}$ | 100                    | mA   |                               |
| Storage temperature          | $T_{stg}$             | -65 to +150            | °C   |                               |

Note: 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.

## Recommended Operating Conditions

| Item                                 | Symbol     | Ratings       | Unit | Conditions                               |
|--------------------------------------|------------|---------------|------|------------------------------------------|
| Supply voltage                       | $V_{CC}$   | 1.5 to 5.5    | V    | Data hold                                |
|                                      |            | 1.65 to 5.5   |      | At operation                             |
| Input / Output voltage               | $V_I$      | 0 to 5.5      | V    | A                                        |
|                                      | $V_O$      | 0 to $V_{CC}$ |      | Y                                        |
| Operating temperature                | $T_a$      | -40 to 85     | °C   |                                          |
| Output current                       | $I_{OH}$   | -4            | mA   | $V_{CC} = 1.65\text{ V}$                 |
|                                      |            | -8            |      | $V_{CC} = 2.3\text{ V}$                  |
|                                      |            | -12           |      | $V_{CC} = 2.7\text{ V}$                  |
|                                      |            | -24           |      | $V_{CC} = 3.0\text{ V to }5.5\text{ V}$  |
|                                      | $I_{OL}$   | 4             | mA   | $V_{CC} = 1.65\text{ V}$                 |
|                                      |            | 8             |      | $V_{CC} = 2.3\text{ V}$                  |
|                                      |            | 12            |      | $V_{CC} = 2.7\text{ V}$                  |
|                                      |            | 24            |      | $V_{CC} = 3.0\text{ V to }5.5\text{ V}$  |
| Input rise / fall time <sup>*1</sup> | $t_r, t_f$ | 20            | ns/V | $V_{CC} = 1.65\text{ V to }2.7\text{ V}$ |
|                                      |            | 10            |      | $V_{CC} = 3.0\text{ V to }5.5\text{ V}$  |

Notes: 1. This item guarantees maximum limit when one input switches.

Waveform: Refer to test circuit of switching characteristics.

## Electrical Characteristics

| Item                     | Symbol           | V <sub>CC</sub> (V) | Ta = −40 to 85°C      |                       | Unit | Test Conditions                                                                                |
|--------------------------|------------------|---------------------|-----------------------|-----------------------|------|------------------------------------------------------------------------------------------------|
|                          |                  |                     | Min                   | Max                   |      |                                                                                                |
| Input voltage            | V <sub>IH</sub>  | 1.65 to 1.95        | V <sub>CC</sub> ×0.65 | —                     | V    |                                                                                                |
|                          |                  | 2.3 to 2.7          | 1.7                   | —                     |      |                                                                                                |
|                          |                  | 2.7 to 3.6          | 2.0                   | —                     |      |                                                                                                |
|                          |                  | 4.5 to 5.5          | V <sub>CC</sub> ×0.7  | —                     |      |                                                                                                |
|                          | V <sub>IL</sub>  | 1.65 to 1.95        | —                     | V <sub>CC</sub> ×0.35 | V    |                                                                                                |
|                          |                  | 2.3 to 2.7          | —                     | 0.7                   |      |                                                                                                |
|                          |                  | 2.7 to 3.6          | —                     | 0.8                   |      |                                                                                                |
|                          |                  | 4.5 to 5.5          | —                     | V <sub>CC</sub> ×0.3  |      |                                                                                                |
| Output voltage           | V <sub>OH</sub>  | 1.65 to 5.5         | V <sub>CC</sub> −0.2  | —                     | V    | I <sub>OH</sub> = −100 μA                                                                      |
|                          |                  | 1.65                | 1.2                   | —                     |      | I <sub>OH</sub> = −4 mA                                                                        |
|                          |                  | 2.3                 | 1.7                   | —                     |      | I <sub>OH</sub> = −8 mA                                                                        |
|                          |                  | 2.7                 | 2.2                   | —                     |      | I <sub>OH</sub> = −12 mA                                                                       |
|                          |                  | 3.0                 | 2.4                   | —                     |      |                                                                                                |
|                          |                  | 3.0                 | 2.2                   | —                     |      | I <sub>OH</sub> = −24 mA                                                                       |
|                          |                  | 4.5                 | 3.8                   | —                     |      |                                                                                                |
|                          | V <sub>OL</sub>  | 1.65 to 5.5         | —                     | 0.2                   | V    | I <sub>OL</sub> = 100 μA                                                                       |
|                          |                  | 1.65                | —                     | 0.45                  |      | I <sub>OL</sub> = 4 mA                                                                         |
|                          |                  | 2.3                 | —                     | 0.7                   |      | I <sub>OL</sub> = 8 mA                                                                         |
|                          |                  | 2.7                 | —                     | 0.4                   |      | I <sub>OL</sub> = 12 mA                                                                        |
|                          |                  | 3.0                 | —                     | 0.55                  |      | I <sub>OL</sub> = 24 mA                                                                        |
|                          |                  | 4.5                 | —                     | 0.55                  |      |                                                                                                |
|                          |                  |                     |                       |                       |      |                                                                                                |
| Input current            | I <sub>IN</sub>  | 0 to 5.5            | —                     | ±5.0                  | μA   | V <sub>IN</sub> = 5.5 V or GND                                                                 |
| Quiescent supply current | I <sub>CC</sub>  | 2.7 to 3.6          | —                     | ±5.0                  | μA   | V <sub>IN</sub> = 3.6 V to 5.5 V                                                               |
|                          |                  | 2.7 to 5.5          | —                     | 5.0                   |      | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                       |
|                          | ΔI <sub>CC</sub> | 2.7 to 3.6          | —                     | 500                   | μA   | V <sub>IN</sub> = one input at (V <sub>CC</sub> −0.6)V, other inputs at V <sub>CC</sub> or GND |

## Switching Characteristics

| Item                                   | Symbol            | V <sub>CC</sub> (V) | Ta = -40 to 85°C |     |     | Unit | From<br>(Input) | To<br>(Output) |
|----------------------------------------|-------------------|---------------------|------------------|-----|-----|------|-----------------|----------------|
|                                        |                   |                     | Min              | Typ | Max |      |                 |                |
| Propagation delay time                 | t <sub>PLH</sub>  | 1.8±0.15            | 1.0              | —   | 8.0 | ns   | A               | Y              |
|                                        | t <sub>PHL</sub>  | 2.5±0.2             | 1.0              | —   | 7.5 |      |                 |                |
|                                        |                   | 2.7                 | 1.0              | —   | 5.5 |      |                 |                |
|                                        |                   | 3.3±0.3             | 1.0              | —   | 4.5 |      |                 |                |
|                                        |                   | 5.0±0.5             | 1.0              | —   | 4.0 |      |                 |                |
| Between output pins skew* <sup>1</sup> | t <sub>OSLH</sub> | 1.8±0.15            | —                | —   | —   | ns   |                 |                |
|                                        | t <sub>OSHL</sub> | 2.5±0.2             | —                | —   | —   |      |                 |                |
|                                        |                   | 2.7                 | —                | —   | —   |      |                 |                |
|                                        |                   | 3.3±0.3             | —                | —   | 1.0 |      |                 |                |
|                                        |                   | 5.0±0.5             | —                | —   | 1.0 |      |                 |                |
| Input capacitance                      | C <sub>IN</sub>   | 3.3                 | —                | 5.0 | —   | pF   |                 |                |

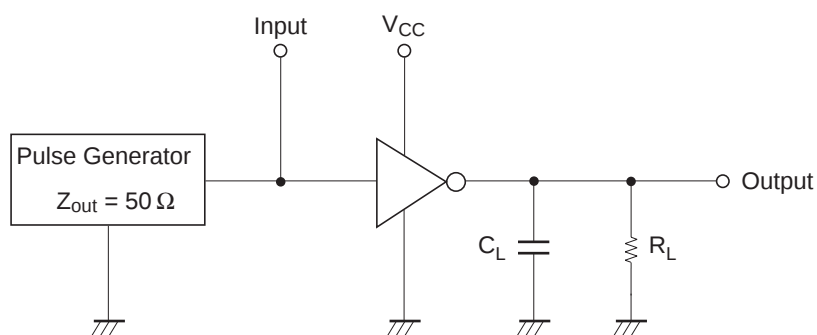
Note: 1. This parameter is characterized but not tested.

$$t_{OSLH} = |t_{PLHm} - t_{PLHn}|, t_{OSHL} = |t_{PHLm} - t_{PHLn}|$$

## Operating Characteristics

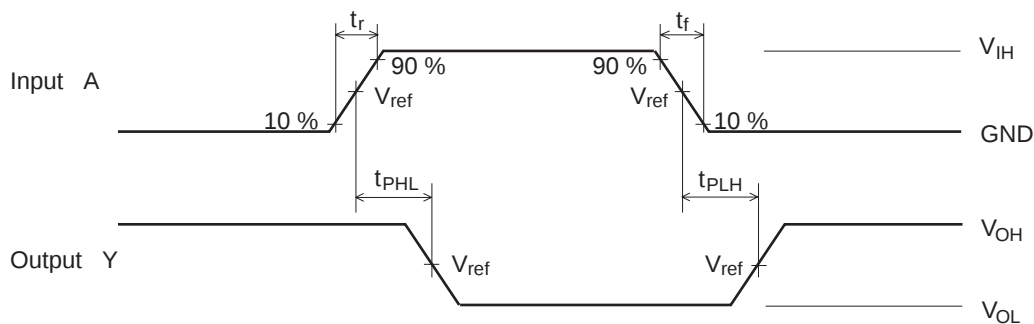
| Item              | Symbol          | V <sub>CC</sub> (V) | Ta = 25°C |     |     | Unit | Test conditions |
|-------------------|-----------------|---------------------|-----------|-----|-----|------|-----------------|
|                   |                 |                     | Min       | Typ | Max |      |                 |
| Power dissipation | C <sub>PD</sub> | 1.8                 | —         | 15  | —   | pF   | f = 10 MHz      |
| Capacitance       |                 | 2.5                 | —         | 16  | —   |      |                 |
|                   |                 | 3.3                 | —         | 18  | —   |      |                 |
|                   |                 | 5.0                 | —         | 22  | —   |      |                 |

## Test Circuit



Note: 1.  $C_L$  includes probe and jig capacitance.

## Waveforms



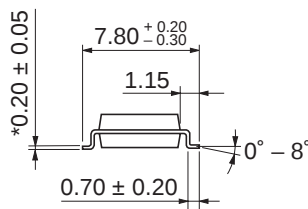
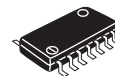
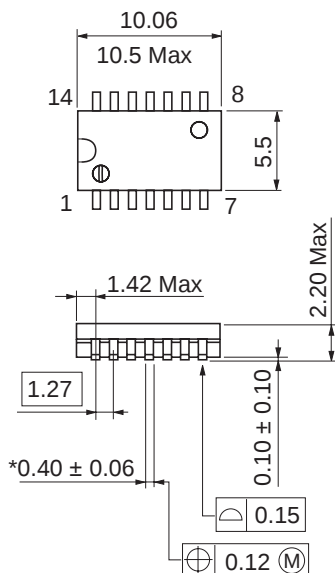
| V <sub>CC</sub> (V)          | INPUTS          |                                | V <sub>ref</sub>    | C <sub>L</sub> | R <sub>L</sub> |
|------------------------------|-----------------|--------------------------------|---------------------|----------------|----------------|
|                              | V <sub>IH</sub> | t <sub>r</sub> /t <sub>f</sub> |                     |                |                |
| V <sub>CC</sub> = 1.8±0.15 V | V <sub>CC</sub> | ≤ 2 ns                         | 1/2 V <sub>CC</sub> | 30 pF          | 1.0 kΩ         |
| V <sub>CC</sub> = 2.5±0.2 V  | V <sub>CC</sub> | ≤ 2 ns                         | 1/2 V <sub>CC</sub> | 30 pF          | 500 Ω          |
| V <sub>CC</sub> = 2.7 V      | 2.7 V           | ≤ 2.5 ns                       | 1.5 V               | 50 pF          | 500 Ω          |
| V <sub>CC</sub> = 3.3±0.3 V  | 2.7 V           | ≤ 2.5 ns                       | 1.5 V               | 50 pF          | 500 Ω          |
| V <sub>CC</sub> = 5.0±0.5 V  | V <sub>CC</sub> | ≤ 2.5 ns                       | 1/2 V <sub>CC</sub> | 50 pF          | 500 Ω          |

Note: 1. Input waveform : PRR = 10 MHz, duty cycle 50%.

## Package Dimensions

As of January, 2003

Unit: mm

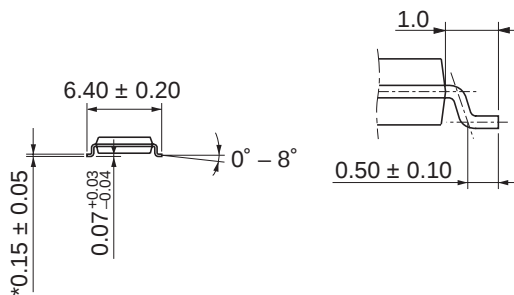
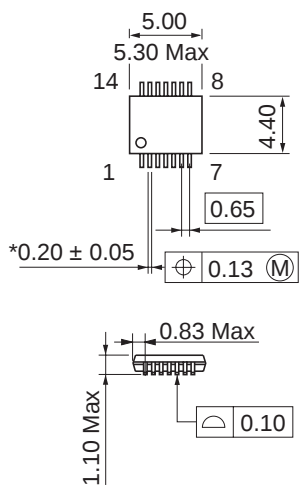


\*Ni/Pd/Au plating

|                        |          |
|------------------------|----------|
| Package Code           | FP-14DAV |
| JEDEC                  | —        |
| JEITA                  | Conforms |
| Mass (reference value) | 0.23 g   |

As of January, 2003

Unit: mm



\*Ni/Pd/Au plating

|                        |          |
|------------------------|----------|
| Package Code           | TTP-14DV |
| JEDEC                  | —        |
| JEITA                  | —        |
| Mass (reference value) | 0.05 g   |

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