FAIRCHILD SEMICONDUCTOR™

February 1992
Revised June 2001

# 74LVQ04
# Low Voltage Hex Inverter

## General Description

The LVQ04 contains six inverters.

## Features

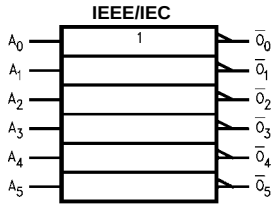
- Ideal for low power/low noise 3.3V applications
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Guaranteed pin-to-pin skew AC performance
- Guaranteed incident wave switching into 75Ω

## Ordering Code:

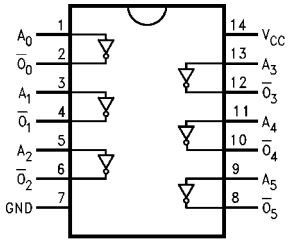
| Ordering Number | Package Number | Package Description |
|---|---|---|
| 74LVQ04SC | M14A | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| 74LVQ04SJ | M14D | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

## Logic Symbol




## Connection Diagram




## Pin Descriptions

| Pin Names | Description |
|---|---|
| $A_n$ | Inputs |
| $\overline{O}_n$ | Outputs |

## Absolute Maximum Ratings(Note 1)

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | −0.5V to +7.0V |
| DC Input Diode Current ($I_{IK}$) | |
| $V_I$ = −0.5V | −20 mA |
| $V_I$ = $V_{CC}$ + 0.5V | +20 mA |
| DC Input Voltage ($V_I$) | −0.5V to $V_{CC}$ + 0.5V |
| DC Output Diode Current ($I_{OK}$) | |
| $V_O$ = −0.5V | −20 mA |
| $V_O$ = $V_{CC}$ + 0.5V | +20 mA |
| DC Output Voltage ($V_O$) | −0.5V to $V_{CC}$ + 0.5V |
| DC Output Source | |
| or Sink Current ($I_O$) | ±50 mA |
| DC $V_{CC}$ or Ground Current | |
| ($I_{CC}$ or $I_{GND}$) | ±200 mA |
| Storage Temperature ($T_{STG}$) | −65°C to +150°C |
| DC Latch-Up Source or | |
| Sink Current | ±100 mA |

## Recommended Operating Conditions (Note 2)

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | 2.0V to 3.6V |
| Input Voltage ($V_I$) | 0V to $V_{CC}$ |
| Output Voltage ($V_O$) | 0V to $V_{CC}$ |
| Operating Temperature ($T_A$) | −40°C to +85°C |
| Minimum Input Edge Rate (ΔV/Δt) | |
| $V_{IN}$ from 0.8V to 2.0V | |
| $V_{CC}$ @ 3.0V | 125 mV/ns |

**Note 1:** The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Note 2:** Unused inputs must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

| Symbol | Parameter | $V_{CC}$ (V) | $T_A$ = +25°C | | $T_A$ = −40°C to +85°C | Units | Conditions |
|---|---|---|---|---|---|---|---|
| | | | Typ | Guaranteed Limits | | | |
| $V_{IH}$ | Minimum High Level Input Voltage | 3.0 | 1.5 | 2.0 | 2.0 | V | $V_{OUT}$ = 0.1V or $V_{CC}$ − 0.1V |
| $V_{IL}$ | Maximum Low Level Input Voltage | 3.0 | 1.5 | 0.8 | 0.8 | V | $V_{OUT}$ = 0.1V or $V_{CC}$ − 0.1V |
| $V_{OH}$ | Minimum High Level Output Voltage | 3.0 | 2.99 | 2.9 | 2.9 | V | $I_{OUT}$ = −50 μA |
| | | 3.0 | | 2.58 | 2.48 | V | $V_{IN}$ = $V_{IL}$ or $V_{IH}$ (Note 3) $I_{OH}$ = −12 mA |
| $V_{OL}$ | Maximum Low Level Output Voltage | 3.0 | 0.002 | 0.1 | 0.1 | V | $I_{OUT}$ = 50 μA |
| | | 3.0 | | 0.36 | 0.44 | V | $V_{IN}$ = $V_{IL}$ or $V_{IH}$ (Note 3) $I_{OL}$ = 12 mA |
| $I_{IN}$ | Maximum Input Leakage Current | 3.6 | | ±0.1 | ±1.0 | μA | $V_I$ = $V_{CC}$, GND |
| $I_{OLD}$ | Minimum Dynamic (Note 4) Output Current | 3.6 | | | 36 | mA | $V_{OLD}$ = 0.8V Max (Note 5) |
| $I_{OHD}$ | | 3.6 | | | −25 | mA | $V_{OHD}$ = 2.0V Min (Note 5) |
| $I_{CC}$ | Maximum Quiescent Supply Current | 3.6 | | 2.0 | 20.0 | μA | $V_{IN}$ = $V_{CC}$ or GND |
| $V_{OLP}$ | Quiet Output Maximum Dynamic $V_{OL}$ | 3.3 | 0.8 | 1.1 | | V | (Note 6)(Note 7) |
| $V_{OLV}$ | Quiet Output Minimum Dynamic $V_{OL}$ | 3.3 | −0.8 | −1.1 | | V | (Note 6)(Note 7) |
| $V_{IHD}$ | Maximum High Level Dynamic Input Voltage | 3.3 | 1.7 | 2.0 | | V | (Note 6)(Note 8) |
| $V_{ILD}$ | Maximum Low Level Dynamic Input Voltage | 3.3 | 1.6 | 0.8 | | V | (Note 6)(Note 8) |

**Note 3:** All outputs loaded; thresholds on input associated with output under test.

**Note 4:** Maximum test duration 2.0 ms, one output loaded at a time.

**Note 5:** Incident wave switching on transmission lines with impedances as low as 75Ω for commercial temperature range is guaranteed for 74LVQ.

**Note 6:** Worst case package.

**Note 7:** Max number of outputs defined as (n). Data inputs are driven 0V to 3.3V; one output at GND.

**Note 8:** Max number of Data Inputs (n) switching. (n − 1) inputs switching 0V to 3.3V. Input-under-test switching: 3.3V to threshold ($V_{ILD}$) 0V to threshold ($V_{IHD}$) f = 1 MHz.

## AC Electrical Characteristics

| Symbol | Parameter | $V_{CC}$ (V) | $T_A = +25°C$, $C_L = 50$ pF | | | $T_A = -40°$ C to $+85°C$, $C_L = 50$ pF | | Units |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | |
| $t_{PLH}$ | Propagation Delay | 2.7 | 1.5 | 5.4 | 12.7 | 1.0 | 14.0 | ns |
| | | $3.3 \pm 0.3$ | 1.5 | 4.5 | 9.0 | 1.0 | 10.0 | |
| $t_{PHL}$ | Propagation Delay | 2.7 | 1.5 | 5.4 | 12.0 | 1.0 | 12.0 | ns |
| | | $3.3 \pm 0.3$ | 1.5 | 4.5 | 8.5 | 1.0 | 9.5 | |
| $t_{OSHL}$ | Output to Output Skew (Note 9) | 2.7 | | 1.0 | 1.5 | | 1.5 | ns |
| $t_{OSLH}$ | Data to Output | $3.3 \pm 0.3$ | | 1.0 | 1.5 | | 1.5 | |

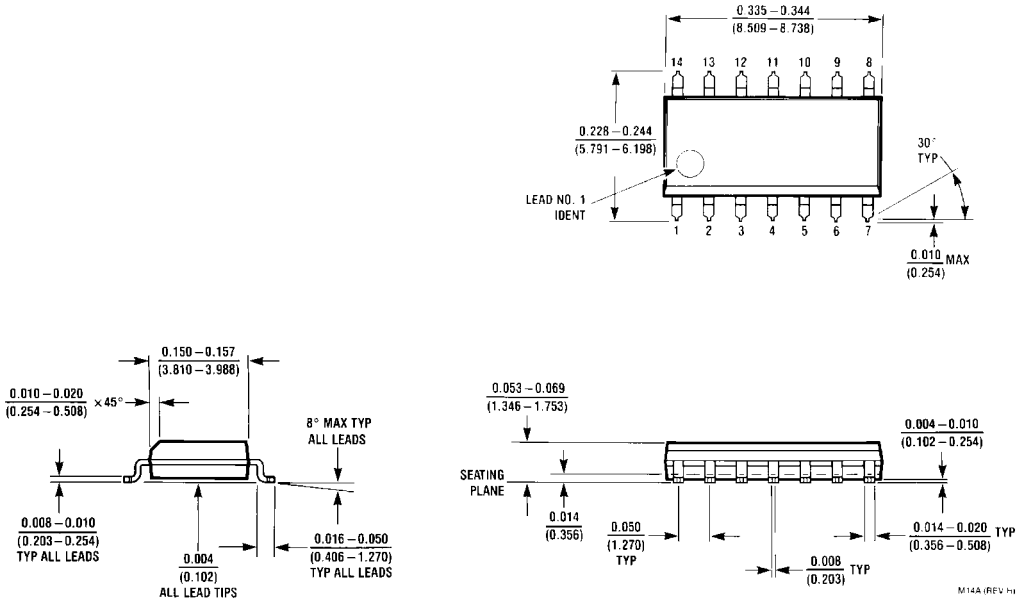
**Note 9:** Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW ($t_{OSHL}$) or LOW-to-HIGH ($t_{OSLH}$). Parameter guaranteed by design.

## Capacitance

| Symbol | Parameter | Typ | Units | Conditions |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | 4.5 | pF | $V_{CC}$ = Open |
| $C_{PD}$ (Note 10) | Power Dissipation Capacitance | 17 | pF | $V_{CC}$ = 3.3V |

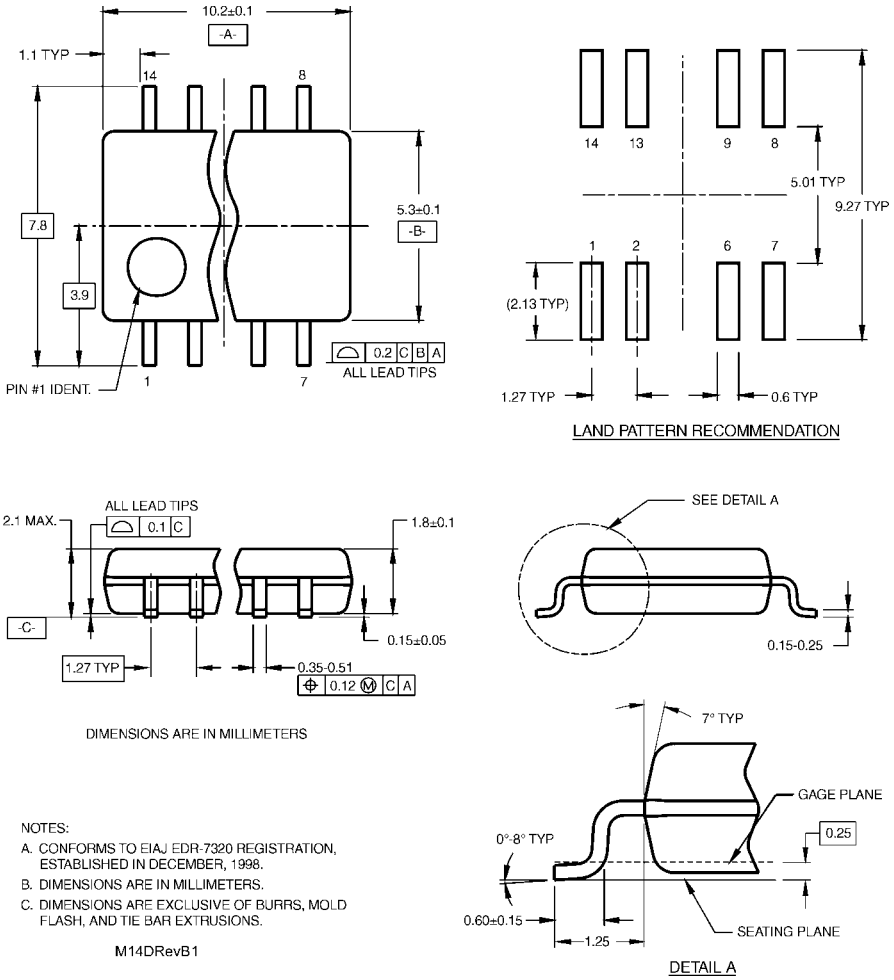
**Note 10:** $C_{PD}$ is measured at 10 MHz.

## Physical Dimensions inches (millimeters) unless otherwise noted




**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow**
**Package Number M14A**

## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)




NOTES:

A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M14DRevB1

**14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**
**Package Number M14D**



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