

## 74LVX14

### Low Voltage Hex Inverter with Schmitt Trigger Input

#### General Description

The LVX14 contains six inverter gates each with a Schmitt trigger input. They are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals. In addition, they have a greater noise margin than conventional inverters.

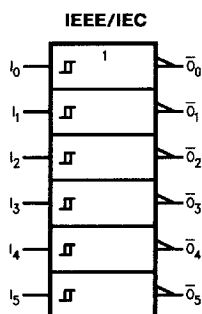
The LVX14 has hysteresis between the positive-going and negative-going input thresholds (typically 1.0V) which is determined internally by transistor ratios and is essentially insensitive to temperature and supply voltage variations.

The inputs tolerate voltages up to 7V allowing the interface of 5V systems to 3V systems.

#### Features

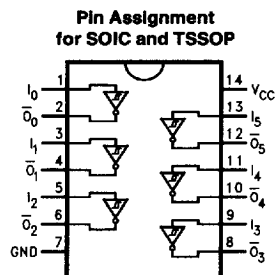
- Input voltage level translation from 5V to 3V
- Ideal for low power/low noise 3.3V applications
- Available in SOIC JEDEC, SOIC EIAJ and TSSOP packages
- Guaranteed simultaneous switching noise level and dynamic threshold performance

#### Logic Symbol



TL/F/11603-2

#### Connection Diagram



TL/F/11603-1

| Pin Names | Description |
|-----------|-------------|
| $I_n$     | Inputs      |
| $O_n$     | Outputs     |

#### Truth Table

| Input | Output    |
|-------|-----------|
| A     | $\bar{O}$ |
| L     | H         |
| H     | L         |

|                       | SOIC JEDEC            | SOIC EIAJ               | TSSOP                     |
|-----------------------|-----------------------|-------------------------|---------------------------|
| Order Number          | 74LVX14M<br>74LVX14MX | 74LVX14SJ<br>74LVX14SJX | 74LVX14MTC<br>74LVX14MTCX |
| See NS Package Number | M14A                  | M14D                    | MTC14                     |

**Absolute Maximum Ratings** (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

|                                                         |                          |
|---------------------------------------------------------|--------------------------|
| Supply Voltage ( $V_{CC}$ )                             | -0.5V to +7.0V           |
| DC Input Diode Current ( $I_{IK}$ )                     |                          |
| $V_I = -0.5V$                                           | -20 mA                   |
| DC Input Voltage ( $V_I$ )                              | -0.5V to 7V              |
| 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 ( $I_O$ )              | $\pm 25$ mA              |
| DC $V_{CC}$ or Ground Current ( $I_{CC}$ or $I_{GND}$ ) | $\pm 50$ mA              |
| Storage Temperature ( $T_{STG}$ )                       | -65°C to +150°C          |
| Power Dissipation                                       | 180 mW                   |

Note: 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" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Recommended Operating Conditions**

|                                                      |                    |
|------------------------------------------------------|--------------------|
| Supply Voltage ( $V_{CC}$ )                          | 2.0V to 3.6V       |
| Input Voltage ( $V_I$ )                              | 0V to 5.5V         |
| Output Voltage ( $V_O$ )                             | 0V to $V_{CC}$     |
| Operating Temperature ( $T_A$ )                      | -40°C to +85°C     |
| Input Rise and Fall Time ( $\Delta t_r/\Delta t_f$ ) | 0 ns/V to 100 ns/V |

**DC Electrical Characteristics**

| Symbol          | Parameter                 | V <sub>CC</sub> | 74LVX14                |      |     | 74LVX14                            |     | Units | Conditions                                           |                          |
|-----------------|---------------------------|-----------------|------------------------|------|-----|------------------------------------|-----|-------|------------------------------------------------------|--------------------------|
|                 |                           |                 | T <sub>A</sub> = +25°C |      |     | T <sub>A</sub> =<br>−40°C to +85°C |     |       |                                                      |                          |
|                 |                           |                 | Min                    | Typ  | Max | Min                                | Max |       |                                                      |                          |
| V <sub>I+</sub> | Positive Threshold        | 3.0             | 2.2                    |      |     | 2.2                                |     | V     |                                                      |                          |
| V <sub>I−</sub> | Negative Threshold        | 3.0             | 0.9                    |      |     | 0.9                                |     | V     |                                                      |                          |
| V <sub>H</sub>  | Hysteresis                | 3.0             | 0.3      1.2           |      |     | 0.3      1.2                       |     | V     |                                                      |                          |
| V <sub>OH</sub> | High Level Output Voltage | 2.0             | 1.9                    | 2.0  |     | 1.9                                |     | V     | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> | I <sub>OH</sub> = −50 μA |
|                 |                           | 3.0             | 2.9                    | 3.0  |     | 2.9                                |     |       |                                                      | I <sub>OH</sub> = −50 μA |
|                 |                           | 3.0             | 2.58                   |      |     | 2.48                               |     |       |                                                      | I <sub>OH</sub> = −4 mA  |
| V <sub>OL</sub> | Low Level Output Voltage  | 2.0             | 0.0                    | 0.1  |     | 0.1                                |     | V     | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> | I <sub>OL</sub> = 50 μA  |
|                 |                           | 3.0             | 0.0                    | 0.1  |     | 0.1                                |     |       |                                                      | I <sub>OL</sub> = 50 μA  |
|                 |                           | 3.0             |                        | 0.36 |     | 0.44                               |     |       |                                                      | I <sub>OL</sub> = 4 mA   |
| I <sub>IN</sub> | Input Leakage Current     | 3.6             | ±0.1                   |      |     | ±1.0                               |     | μA    | V <sub>IN</sub> = 5.5V or GND                        |                          |
| I <sub>CC</sub> | Quiescent Supply Current  | 3.6             | 2.0                    |      |     | 20                                 |     | μA    | V <sub>IN</sub> = V <sub>CC</sub> or GND             |                          |

**Noise Characteristics:** See Section 2 for Test Methodology

| Symbol           | Parameter                                    | V <sub>CC</sub><br>(V) | 74LVX14               |       | Units | C <sub>L</sub> (pF) |
|------------------|----------------------------------------------|------------------------|-----------------------|-------|-------|---------------------|
|                  |                                              |                        | T <sub>A</sub> = 25°C |       |       |                     |
|                  |                                              |                        | Typ                   | Limit |       |                     |
| V <sub>OLP</sub> | Quiet Output Maximum Dynamic V <sub>OL</sub> | 3.3                    | 0.3                   | 0.5   | V     | 50                  |
| V <sub>OLV</sub> | Quiet Output Minimum Dynamic V <sub>OL</sub> | 3.3                    | −0.3                  | −0.5  | V     | 50                  |
| V <sub>IHD</sub> | Minimum High Level Dynamic Input Voltage     | 3.3                    |                       | 2.0   | V     | 50                  |
| V <sub>ILD</sub> | Maximum Low Level Dynamic Input Voltage      | 3.3                    |                       | 0.8   | V     | 50                  |

Note: Input  $t_r = t_f = 3$  ns

**AC Electrical Characteristics:** See Section 2 for Test Methodology

| Symbol                                   | Parameter                         | V <sub>CC</sub><br>(V) | 74LVX14                |      |      | 74LVX14                            |      | Units | C <sub>L</sub> (pF) |
|------------------------------------------|-----------------------------------|------------------------|------------------------|------|------|------------------------------------|------|-------|---------------------|
|                                          |                                   |                        | T <sub>A</sub> = +25°C |      |      | T <sub>A</sub> =<br>−40°C to +85°C |      |       |                     |
|                                          |                                   |                        | Min                    | Typ  | Max  | Min                                | Max  |       |                     |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub>   | Propagation<br>Delay Time         | 2.7                    |                        | 8.7  | 16.3 | 1.0                                | 19.5 | ns    | 15                  |
|                                          |                                   |                        |                        | 11.2 | 19.8 | 1.0                                | 23.0 |       | 50                  |
|                                          |                                   | 3.3 ± 0.3              |                        | 6.8  | 10.6 | 1.0                                | 12.5 |       | 15                  |
|                                          |                                   |                        |                        | 9.3  | 14.1 | 1.0                                | 16.0 |       | 50                  |
| t <sub>OSLH</sub> ,<br>t <sub>OSHL</sub> | Output to Output<br>Skew (Note 1) | 2.7                    |                        |      | 1.5  |                                    | 1.5  | ns    | 50                  |

Note 1: Parameter guaranteed by design. t<sub>OSLH</sub> = |t<sub>PLHm</sub> − t<sub>PLHn</sub>|, t<sub>OSHL</sub> = |t<sub>PHLm</sub> − t<sub>PHLn</sub>|

**Capacitance**

| Symbol          | Parameter                                 | 74LVX14                |     |     | 74LVX14                            |     | Units |
|-----------------|-------------------------------------------|------------------------|-----|-----|------------------------------------|-----|-------|
|                 |                                           | T <sub>A</sub> = +25°C |     |     | T <sub>A</sub> =<br>−40°C to +85°C |     |       |
|                 |                                           | Min                    | Typ | Max | Min                                | Max |       |
| C <sub>IN</sub> | Input Capacitance                         |                        | 4   | 10  |                                    | 10  | pF    |
| C <sub>PD</sub> | Power Dissipation<br>Capacitance (Note 1) |                        | 21  |     |                                    |     | pF    |

Note 1: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:  $I_{CC(opr)} = \frac{C_{PD} \times V_{CC} \times f_{IN} + I_{CC}}{6 \text{ (per Gate)}}$