

## 74LCX11

### Low Voltage Triple 3-Input AND Gate with 5V Tolerant Inputs

#### General Description

The LCX11 is a triple 3-input AND gate with buffered outputs. LCX devices are designed for low voltage (2.5V or 3.3V) operation with the added capability of interfacing to a 5V signal environment.

The 74LCX11 is fabricated with advanced CMOS technology to achieve high speed operation while maintaining CMOS low power dissipation.

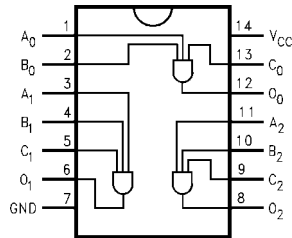
#### Features

- 5V tolerant inputs and outputs
- 2.3V–3.6V  $V_{CC}$  specifications provided
- 6.0ns  $t_{PD}$  max ( $V_{CC} = 3.3V$ ), 10  $\mu A$   $I_{CC}$  max
- Power down high impedance inputs and outputs
- $\pm 24$  mA output drive ( $V_{CC} = 3.0V$ )
- Implements patented noise/EMI reduction circuitry
- Latch-up performance exceeds 500 mA
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V

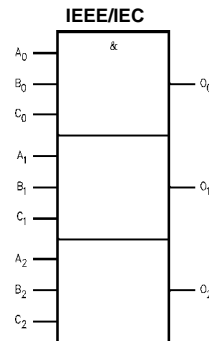
#### Ordering Code:

| Order Number | Package Number | Package Description  |
|--------------|----------------|--|
| 74LCX11M     | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow |
| 74LCX11SJ    | M14D           | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                |
| 74LCX11MTC   | MTC14          | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  |

#### Connection Diagram



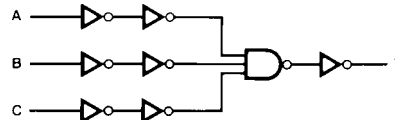
#### Logic Symbol



#### Pin Descriptions

| Pin Names       | Description |
|-----------------|-------------|
| $A_n, B_n, C_n$ | Inputs      |
| $O_n$           | Outputs     |

#### Logic Diagram



| Absolute Maximum Ratings (Note 1) |                                  |                        |                                      |       |  |
|-----------------------------------|----------------------------------|------------------------|--------------------------------------|-------|--|
| Symbol                            | Parameter                        | Value                  | Conditions                           | Units |  |
| $V_{CC}$                          | Supply Voltage                   | -0.5 to +7.0           |                                      | V     |  |
| $V_I$                             | DC Input Voltage                 | -0.5 to +7.0           |                                      | V     |  |
| $V_O$                             | DC Output Voltage                | -0.5 to $V_{CC} + 0.5$ | Output in HIGH or LOW State (Note 2) | V     |  |
| $I_{IK}$                          | DC Input Diode Current           | -50                    | $V_I < GND$                          | mA    |  |
| $I_{OK}$                          | DC Output Diode Current          | -50                    | $V_O < GND$                          | mA    |  |
|                                   |                                  | +50                    | $V_O > V_{CC}$                       |       |  |
| $I_O$                             | DC Output Source/Sink Current    | $\pm 50$               |                                      | mA    |  |
| $I_{CC}$                          | DC Supply Current per Supply Pin | $\pm 100$              |                                      | mA    |  |
| $I_{GND}$                         | DC Ground Current per Ground Pin | $\pm 100$              |                                      | mA    |  |
| $T_{STG}$                         | Storage Temperature              | -65 to +150            |                                      | °C    |  |

| Recommended Operating Conditions (Note 3) |   |  |            |                                 |    |
|---|---|--|------------|---------------------------------|----|
| Symbol                                    | Parameter   | Min  | Max        | Units                           |    |
| $V_{CC}$                                  | Supply Voltage  | Operating<br>Data Retention  | 2.0<br>1.5 | 3.6<br>3.6                      | V  |
| $V_I$                                     | Input Voltage   | 0  | 5.5        | V                               |    |
| $V_O$                                     | Output Voltage  | HIGH or LOW State  | 0          | $V_{CC}$                        | V  |
| $I_{OH}/I_{OL}$                           | Output Current  | $V_{CC} = 3.0V - 3.6V$<br>$V_{CC} = 2.7V - 3.0V$<br>$V_{CC} = 2.3V - 2.7V$ |            | $\pm 24$<br>$\pm 12$<br>$\pm 8$ | mA |
| $T_A$                                     | Free-Air Operating Temperature                            | -40  | 85         | °C                              |    |
| $\Delta t/\Delta V$                       | Input Edge Rate, $V_{IN} = 0.8V - 2.0V$ , $V_{CC} = 3.0V$ | 0  | 10         | ns/V                            |    |

**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:**  $I_O$  Absolute Maximum Rating must be observed.

**Note 3:** Unused inputs must be held HIGH or LOW. They may not float.

### DC Electrical Characteristics

| Symbol          | Parameter                      | Conditions   | $V_{CC}$<br>(V)                       | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |                                  | Units         |
|-----------------|--------------------------------|--|---------------------------------------|---|----------------------------------|---------------|
|                 |                                |  |                                       | Min   | Max                              |               |
| $V_{IH}$        | HIGH Level Input Voltage       |  | 2.3 - 2.7<br>2.7 - 3.6                | 1.7<br>2.0                                      |                                  | V             |
| $V_{IL}$        | LOW Level Input Voltage        |  | 2.3 - 2.7<br>2.7 - 3.6                |   | 0.7<br>0.8                       | V             |
| $V_{OH}$        | HIGH Level Output Voltage      | $I_{OH} = -100 \mu\text{A}$<br>$I_{OH} = -8 \text{ mA}$<br>$I_{OH} = -12 \text{ mA}$<br>$I_{OH} = -18 \text{ mA}$<br>$I_{OH} = -24 \text{ mA}$ | 2.3 - 3.6<br>2.3<br>2.7<br>3.0<br>3.0 | $V_{CC} - 0.2$<br>1.8<br>2.2<br>2.4<br>2.2      |                                  | V             |
| $V_{OL}$        | LOW Level Output Voltage       | $I_{OL} = 100 \mu\text{A}$<br>$I_{OL} = 8 \text{ mA}$<br>$I_{OL} = 12 \text{ mA}$<br>$I_{OL} = 16 \text{ mA}$<br>$I_{OL} = 24 \text{ mA}$      | 2.3 - 3.6<br>2.3<br>2.7<br>3.0<br>3.0 |   | 0.2<br>0.6<br>0.4<br>0.4<br>0.55 | V             |
| $I_I$           | Input Leakage Current          | $0 \leq V_I \leq 5.5V$   | 2.3 - 3.6                             |   | $\pm 5.0$                        | $\mu\text{A}$ |
| $I_{OFF}$       | Power-Off Leakage Current      | $V_I$ or $V_O = 5.5V$  | 0                                     |   | 10                               | $\mu\text{A}$ |
| $I_{CC}$        | Quiescent Supply Current       | $V_I = V_{CC}$ or GND<br>$3.6V \leq V_I \leq 5.5V$   | 2.3 - 3.6<br>2.3 - 3.6                |   | 10<br>$\pm 10$                   | $\mu\text{A}$ |
| $\Delta I_{CC}$ | Increase in $I_{CC}$ per Input | $V_{IH} = V_{CC} - 0.6V$   | 2.3 - 3.6                             |   | 500                              | $\mu\text{A}$ |

## AC Electrical Characteristics

| Symbol     | Parameter                         | $T_A = -40^\circ\text{C to } +85^\circ\text{C}, R_L = 500 \Omega$ |     |                       |     |                          |     | Units |
|------------|-----------------------------------|---|-----|-----------------------|-----|--------------------------|-----|-------|
|            |                                   | $V_{CC} = 3.3V \pm 0.3V$  |     | $V_{CC} = 2.7V$       |     | $V_{CC} = 2.5V \pm 0.2V$ |     |       |
|            |                                   | $C_L = 50 \text{ pF}$   |     | $C_L = 50 \text{ pF}$ |     | $C_L = 30 \text{ pF}$    |     |       |
|            |                                   | Min   | Max | Min                   | Max | Min                      | Max |       |
| $t_{PLH}$  | Propagation Delay                 | 1.5   | 6.0 | 1.5                   | 7.0 | 1.5                      | 7.2 | ns    |
| $t_{PHL}$  |                                   | 1.5   | 6.0 | 1.5                   | 7.0 | 1.5                      | 7.2 |       |
| $t_{OSLH}$ | Output to Output Skew<br>(Note 4) |   | 1.0 |                       |     |                          |     | ns    |
| $t_{OSHL}$ |                                   |   | 1.0 |                       |     |                          |     |       |

**Note 4:** 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 ( $t_{OSLH}$ ).

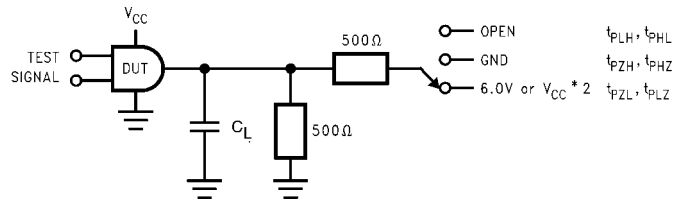
## Dynamic Switching Characteristics

| Symbol    | Parameter                          | Conditions   | $V_{CC}$<br>(V) | $T_A = 25^\circ\text{C}$ | Units |
|-----------|------------------------------------|--|-----------------|--------------------------|-------|
|           |                                    |  |                 | Typical                  |       |
| $V_{OLP}$ | Quiet Output Dynamic Peak $V_{OL}$ | $C_L = 50 \text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$<br>$C_L = 30 \text{ pF}, V_{IH} = 2.5V, V_{IL} = 0V$ | 3.3<br>2.5      | 0.8<br>0.6               | V     |
| $V_{OLV}$ | Quiet Output Dynamic Peak $V_{OL}$ | $C_L = 50 \text{ pF}, V_{IH} = 3.3V, V_{IL} = 0V$<br>$C_L = 30 \text{ pF}, V_{IH} = 2.5V, V_{IL} = 0V$ | 3.3<br>2.5      | -0.8<br>-0.6             | V     |

## Capacitance

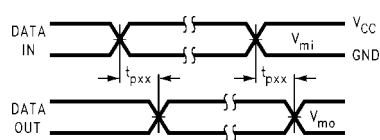
| Symbol    | Parameter                     | Conditions   | Typical | Units |
|-----------|-------------------------------|--|---------|-------|
| $C_{IN}$  | Input Capacitance             | $V_{CC} = \text{Open}, V_I = 0V \text{ or } V_{CC}$              | 7       | pF    |
| $C_{OUT}$ | Output Capacitance            | $V_{CC} = 3.3V, V_I = 0V \text{ or } V_{CC}$                     | 8       | pF    |
| $C_{PD}$  | Power Dissipation Capacitance | $V_{CC} = 3.3V, V_I = 0V \text{ or } V_{CC}, f = 10 \text{ MHz}$ | 25      | pF    |

**AC Loading and Waveforms** Generic for LCX Family

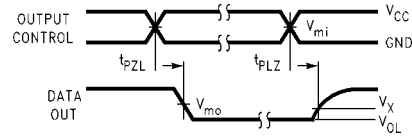


**FIGURE 1. AC Test Circuit**  
 ( $C_L$  includes probe and jig capacitance)

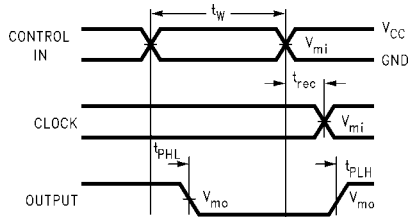
| Test               | Switch   |
|--------------------|--|
| $t_{PLH}, t_{PHL}$ | Open   |
| $t_{PZL}, t_{PLZ}$ | 6V at $V_{CC} = 3.3 \pm 0.3V$<br>$V_{CC} * 2$ at $V_{CC} = 2.5 \pm 0.2V$ |
| $t_{PZH}, t_{PHZ}$ | GND  |



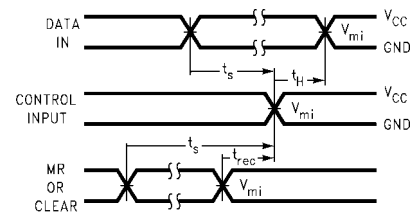
**Waveform for Inverting and Non-Inverting Functions**



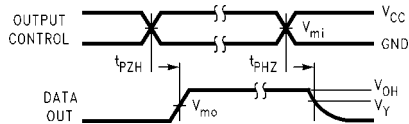
**3-STATE Output Low Enable and Disable Times for Logic**



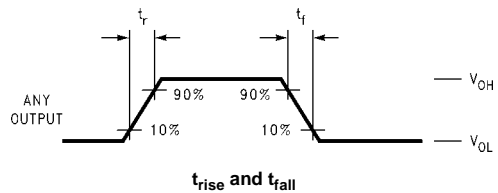
**Propagation Delay, Pulse Width and  $t_{rec}$  Waveforms**



**Setup Time, Hold Time and Recovery Time for Logic**



**3-STATE Output High Enable and Disable Times for Logic**

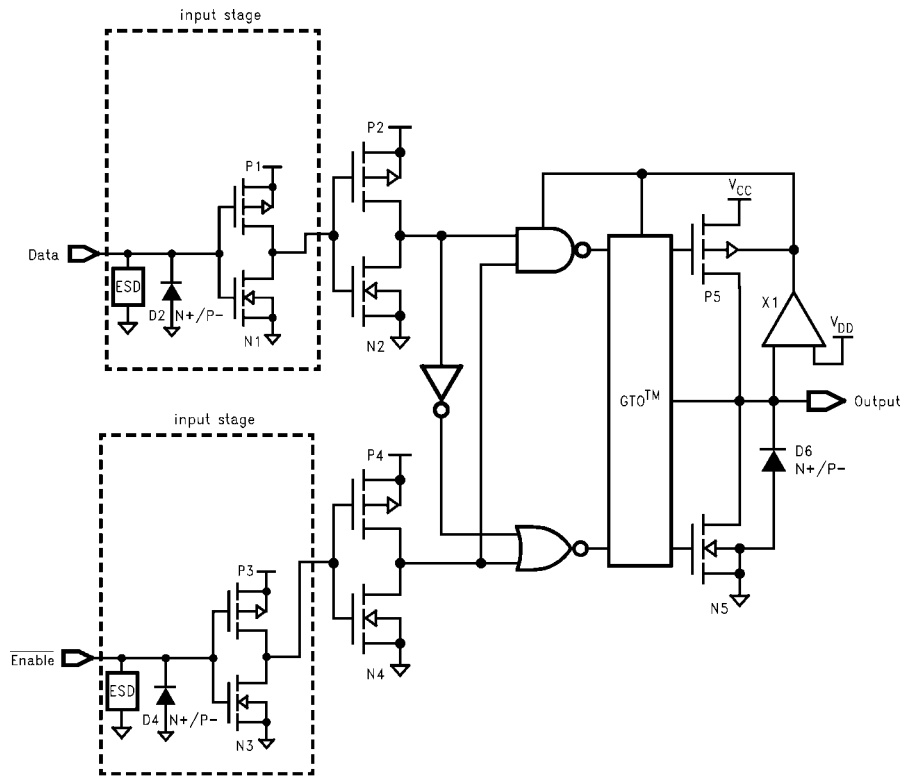


**FIGURE 2. Waveforms**

(Input Pulse Characteristics;  $f=1MHz, t_r=t_f=3ns$ )

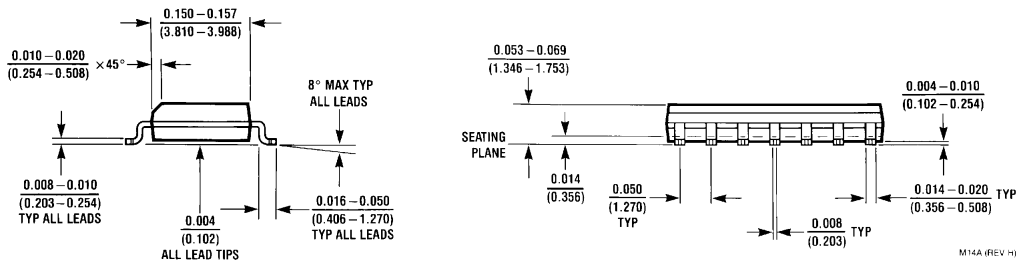
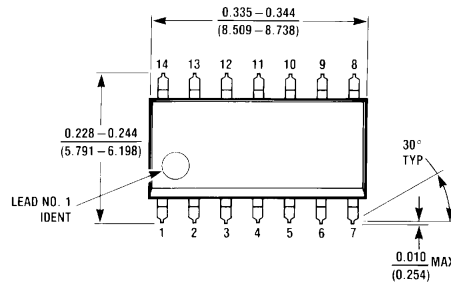
| Symbol   | $V_{CC}$        |                 |                  |
|----------|-----------------|-----------------|------------------|
|          | $3.3V \pm 0.3V$ | 2.7V            | $2.5V \pm 0.2V$  |
| $V_{mi}$ | 1.5V            | 1.5V            | $V_{CC}/2$       |
| $V_{mo}$ | 1.5V            | 1.5V            | $V_{CC}/2$       |
| $V_x$    | $V_{OL} + 0.3V$ | $V_{OL} + 0.3V$ | $V_{OL} + 0.15V$ |
| $V_y$    | $V_{OH} - 0.3V$ | $V_{OH} - 0.3V$ | $V_{OH} - 0.15V$ |

**Schematic Diagram** Generic for LCX Family

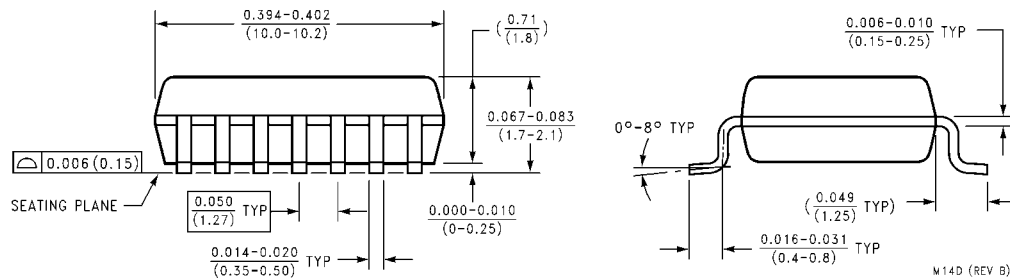
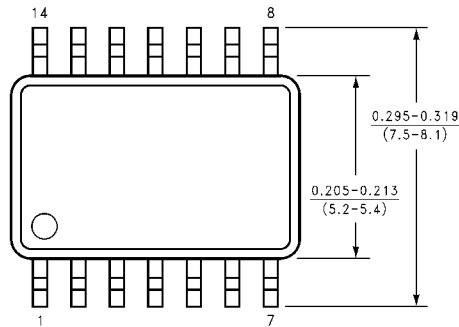


74LCX11

**Physical Dimensions** inches (millimeters) unless otherwise noted

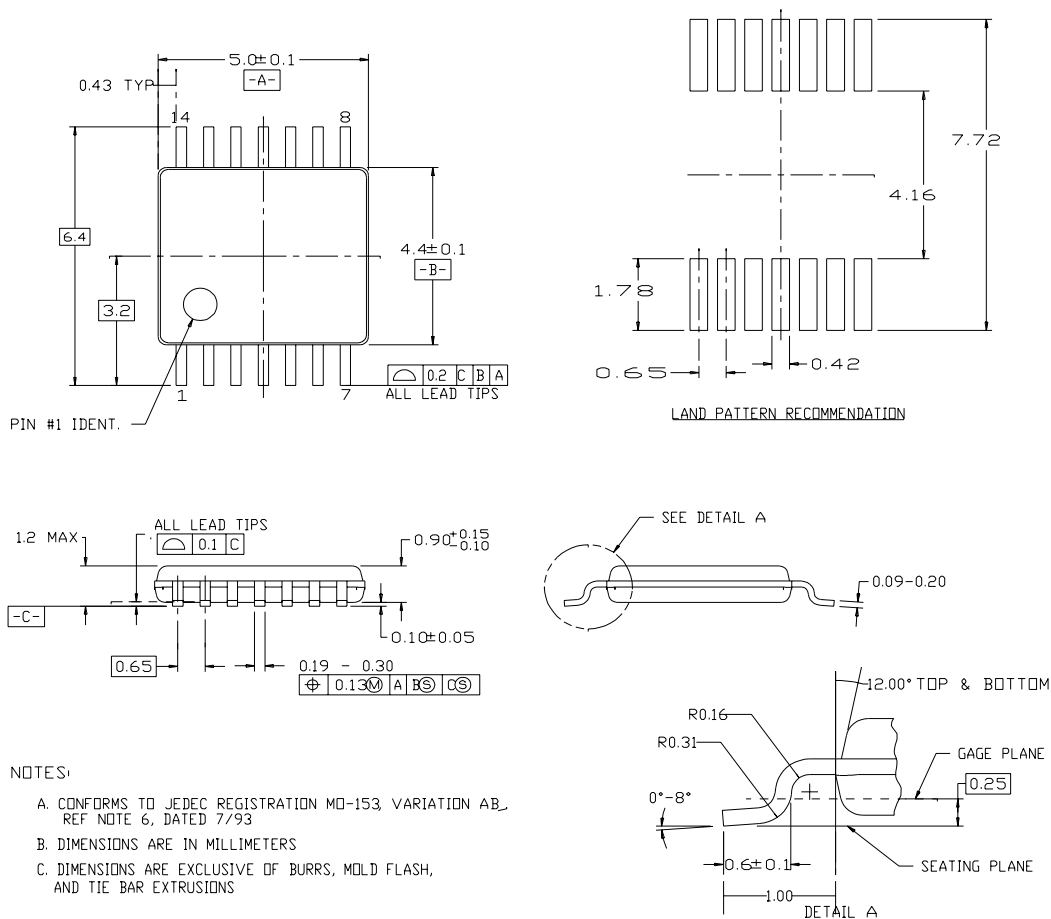


**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow Package Number M14A**



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

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



**14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  
Package Number MTC14**

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