

# MC74LVX14

## Hex Schmitt Inverter

### With 5 V-Tolerant Inputs

The MC74LVX14 is an advanced high speed CMOS Schmitt inverter. The inputs tolerate voltages up to 7 V, allowing the interface of 5 V systems to 3 V systems.

The MC74LVX14 is pin and functionally compatible to the MC74LVX04, but the inputs have hysteresis and, with its Schmitt trigger function, can be used as a line receiver which will receive slow input signals.

#### Features

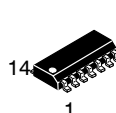
- High Speed:  $t_{PD} = 6.8$  ns (Typ) at  $V_{CC} = 3.3$  V
- Low Power Dissipation:  $I_{CC} = 2$   $\mu$ A (Max) at  $T_A = 25^\circ\text{C}$
- Powerdown Protection Provided on Inputs
- Balanced Propagation Delays
- Low Noise:  $V_{OLP} = 0.5$  V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: Human Body Model > 2000 V;  
Machine Model > 200 V
- These Devices are Pb-Free and are RoHS Compliant



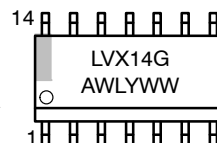
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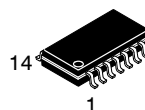
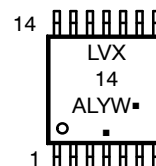
#### MARKING DIAGRAMS



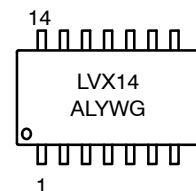
**SOIC-14  
D SUFFIX  
CASE 751A**



**TSSOP-14  
DT SUFFIX  
CASE 948G**



**SOEIAJ-14  
M SUFFIX  
CASE 965**



LVX14 = Specific Device Code  
A = Assembly Location  
WL, L = Wafer Lot  
Y = Year  
WW, W = Work Week  
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

# MC74LVX14

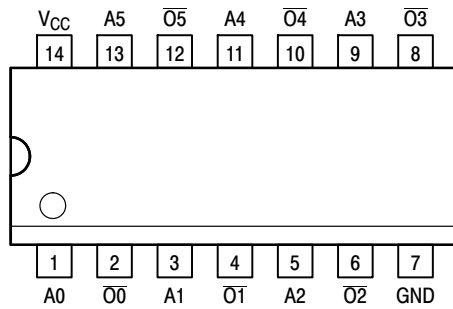


Figure 1. 14-Lead Pinout (Top View)

## PIN NAMES

| Pins                              | Function                    |
|-----------------------------------|-----------------------------|
| A <sub>n</sub><br>$\overline{O}n$ | Data Inputs<br>Data Outputs |

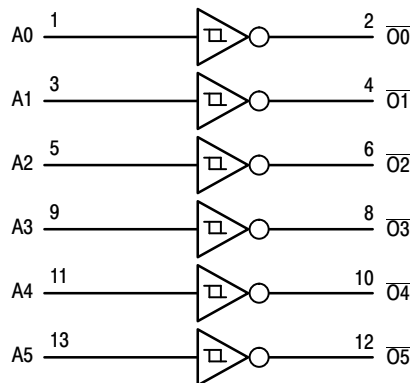


Figure 2. Logic Diagram

## FUNCTION TABLE

| A <sub>n</sub> | $\overline{O}n$ |
|----------------|-----------------|
| L<br>H         | H<br>L          |

## ORDERING INFORMATION

| Device         | Package                | Shipping <sup>†</sup> |
|----------------|------------------------|-----------------------|
| MC74LVX14DR2G  | SOIC-14<br>(Pb-Free)   | 2500 Tape & Reel      |
| MC74LVX14DTR2G | TSSOP-14*              | 2500 Tape & Reel      |
| MC74LVX14MG    | SOEIAJ-14<br>(Pb-Free) | 50 Units / Rail       |
| MC74LVX14MELG  | SOEIAJ-14<br>(Pb-Free) | 2000 Tape & Reel      |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*This package is inherently Pb-Free.

# MC74LVX14

## MAXIMUM RATINGS

| Symbol    | Parameter                                | Value                  | Unit |
|-----------|------------------------------------------|------------------------|------|
| $V_{CC}$  | DC Supply Voltage                        | -0.5 to +7.0           | V    |
| $V_{in}$  | DC Input Voltage                         | -0.5 to +7.0           | V    |
| $V_{out}$ | DC Output Voltage                        | -0.5 to $V_{CC} + 0.5$ | V    |
| $I_{IK}$  | Input Diode Current                      | -20                    | mA   |
| $I_{OK}$  | Output Diode Current                     | $\pm 20$               | mA   |
| $I_{out}$ | DC Output Current, per Pin               | $\pm 25$               | mA   |
| $I_{CC}$  | DC Supply Current, $V_{CC}$ and GND Pins | $\pm 50$               | mA   |
| $P_D$     | Power Dissipation                        | 180                    | mW   |
| $T_{stg}$ | Storage Temperature                      | -65 to +150            | °C   |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

## RECOMMENDED OPERATING CONDITIONS

| Symbol    | Parameter                                | Min | Max      | Unit |
|-----------|------------------------------------------|-----|----------|------|
| $V_{CC}$  | DC Supply Voltage                        | 2.0 | 3.6      | V    |
| $V_{in}$  | DC Input Voltage                         | 0   | 5.5      | V    |
| $V_{out}$ | DC Output Voltage                        | 0   | $V_{CC}$ | V    |
| $T_A$     | Operating Temperature, All Package Types | -40 | +85      | °C   |

## DC ELECTRICAL CHARACTERISTICS

| Symbol   | Parameter                                                      | Test Conditions                  | $V_{CC}$<br>V | $T_A = 25^\circ\text{C}$ |     |           | $T_A = -40 \text{ to } 85^\circ\text{C}$ |           | Unit          |
|----------|----------------------------------------------------------------|----------------------------------|---------------|--------------------------|-----|-----------|------------------------------------------|-----------|---------------|
|          |                                                                |                                  |               | Min                      | Typ | Max       | Min                                      | Max       |               |
| $V_{T+}$ | Positive Threshold Voltage (Figure 5)                          |                                  | 3.0           |                          |     | 2.20      |                                          | 2.20      | V             |
| $V_{T-}$ | Negative Threshold Voltage (Figure 5)                          |                                  | 3.0           | 0.90                     |     |           | 0.90                                     |           | V             |
| $V_H$    | Hysteresis Voltage (Figure 5)                                  |                                  | 3.0           | 0.30                     |     | 1.20      | 0.30                                     | 1.20      | V             |
| $V_{OH}$ | High-Level Output Voltage<br>( $V_{in} = V_{IH}$ or $V_{IL}$ ) | $I_{OH} = -50 \mu\text{A}$       | 2.0           | 1.9                      | 2.0 |           | 1.9                                      |           | V             |
|          |                                                                | $I_{OH} = -50 \mu\text{A}$       | 3.0           | 2.9                      | 3.0 |           | 2.9                                      |           |               |
|          |                                                                | $I_{OH} = -4 \text{ mA}$         | 3.0           | 2.58                     |     |           | 2.48                                     |           |               |
| $V_{OL}$ | Low-Level Output Voltage<br>( $V_{in} = V_{IH}$ or $V_{IL}$ )  | $I_{OL} = 50 \mu\text{A}$        | 2.0           |                          | 0.0 | 0.1       |                                          | 0.1       | V             |
|          |                                                                | $I_{OL} = 50 \mu\text{A}$        | 3.0           |                          | 0.0 | 0.1       |                                          | 0.1       |               |
|          |                                                                | $I_{OL} = 4 \text{ mA}$          | 3.0           |                          |     | 0.36      |                                          | 0.44      |               |
| $I_{in}$ | Input Leakage Current                                          | $V_{in} = 5.5 \text{ V or GND}$  | 3.6           |                          |     | $\pm 0.1$ |                                          | $\pm 1.0$ | $\mu\text{A}$ |
| $I_{CC}$ | Quiescent Supply Current                                       | $V_{in} = V_{CC} \text{ or GND}$ | 3.6           |                          |     | 2.0       |                                          | 20.0      | $\mu\text{A}$ |

## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0 \text{ ns}$ )

| Symbol                     | Parameter                          | Test Conditions                                        | $T_A = 25^\circ\text{C}$ |      |      | $T_A = -40 \text{ to } 85^\circ\text{C}$ |      | Unit |
|----------------------------|------------------------------------|--------------------------------------------------------|--------------------------|------|------|------------------------------------------|------|------|
|                            |                                    |                                                        | Min                      | Typ  | Max  | Min                                      | Max  |      |
| $t_{PLH}$ ,<br>$t_{PHL}$   | Propagation Delay, Input-to-Output | $V_{CC} = 2.7 \text{ V}$ $C_L = 15 \text{ pF}$         |                          | 8.7  | 16.3 | 1.0                                      | 19.5 | ns   |
|                            |                                    | $C_L = 50 \text{ pF}$                                  |                          | 11.2 | 19.8 | 1.0                                      | 23.0 |      |
|                            |                                    | $V_{CC} = 3.3 \pm 0.3 \text{ V}$ $C_L = 15 \text{ pF}$ |                          | 6.8  | 10.6 | 1.0                                      | 12.5 |      |
|                            |                                    | $C_L = 50 \text{ pF}$                                  |                          | 9.3  | 14.1 | 1.0                                      | 16.0 |      |
| $t_{OSHL}$ ,<br>$t_{OSLH}$ | Output-to-Output Skew (Note 1)     | $V_{CC} = 2.7 \text{ V}$ $C_L = 50 \text{ pF}$         |                          |      | 1.5  |                                          | 1.5  | ns   |
|                            |                                    | $V_{CC} = 3.3 \pm 0.3 \text{ V}$ $C_L = 50 \text{ pF}$ |                          |      | 1.5  |                                          | 1.5  |      |

1. 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.

## CAPACITIVE CHARACTERISTICS

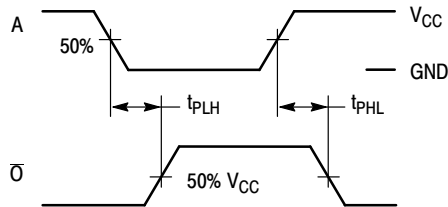
| Symbol   | Parameter                              | $T_A = 25^\circ\text{C}$ |     |     | $T_A = -40 \text{ to } 85^\circ\text{C}$ |     | Unit |
|----------|----------------------------------------|--------------------------|-----|-----|------------------------------------------|-----|------|
|          |                                        | Min                      | Typ | Max | Min                                      | Max |      |
| $C_{in}$ | Input Capacitance                      |                          | 4   | 10  |                                          | 10  | pF   |
| $C_{PD}$ | Power Dissipation Capacitance (Note 2) |                          | 21  |     |                                          |     | pF   |

2.  $C_{PD}$  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:  $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}/6$  (per buffer).  $C_{PD}$  is used to determine the no-load dynamic power consumption;  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

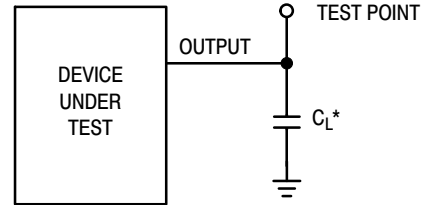
# MC74LVX14

**NOISE CHARACTERISTICS** (Input  $t_r = t_f = 3.0$  ns,  $C_L = 50$  pF,  $V_{CC} = 3.3$  V, Measured in SOIC Package)

| Symbol    | Characteristic                           | $T_A = 25^\circ\text{C}$ |      | Unit |
|-----------|------------------------------------------|--------------------------|------|------|
|           |                                          | Typ                      | Max  |      |
| $V_{OLP}$ | Quiet Output Maximum Dynamic $V_{OL}$    | 0.3                      | 0.5  | V    |
| $V_{OLV}$ | Quiet Output Minimum Dynamic $V_{OL}$    | -0.3                     | -0.5 | V    |
| $V_{IHD}$ | Minimum High Level Dynamic Input Voltage |                          | 2.0  | V    |
| $V_{ILD}$ | Maximum Low Level Dynamic Input Voltage  |                          | 0.9  | V    |

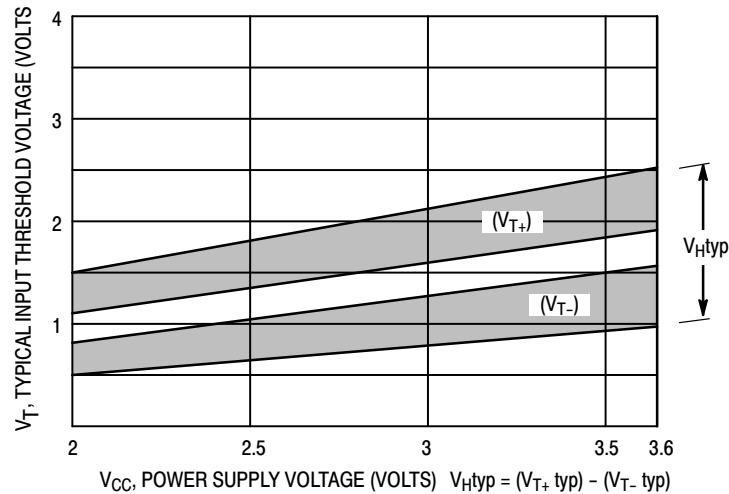


**Figure 3. Switching Waveforms**

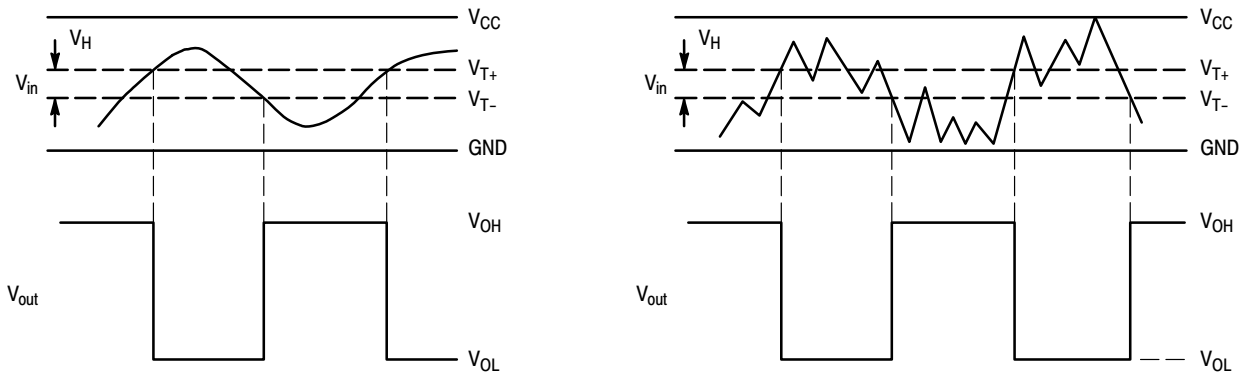


\*Includes all probe and jig capacitance

**Figure 4. Test Circuit**



**Figure 5. Typical Input Threshold,  $V_{T+}$ ,  $V_{T-}$  versus Power Supply Voltage**



(a) A Schmitt-Trigger Squares Up Inputs With Slow Rise and Fall Times

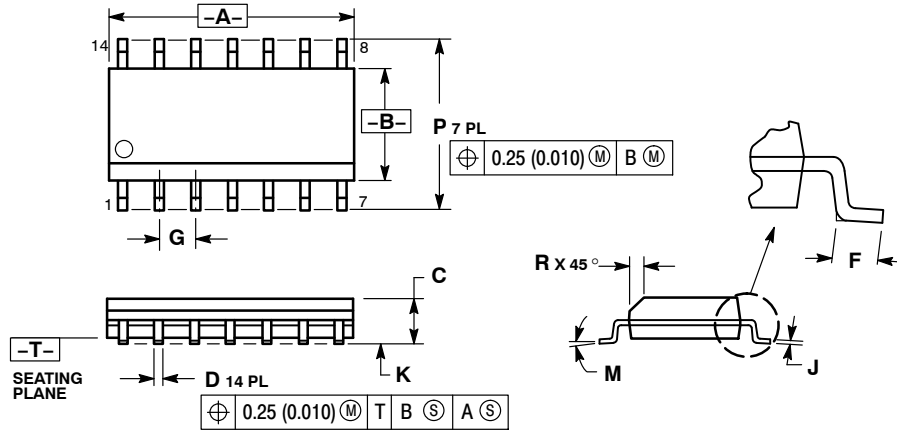
(b) A Schmitt-Trigger Offers Maximum Noise Immunity

**Figure 6. Typical Schmitt-Trigger Applications**

# MC74LVX14

## PACKAGE DIMENSIONS

SOIC-14  
D SUFFIX  
CASE 751A-03  
ISSUE J

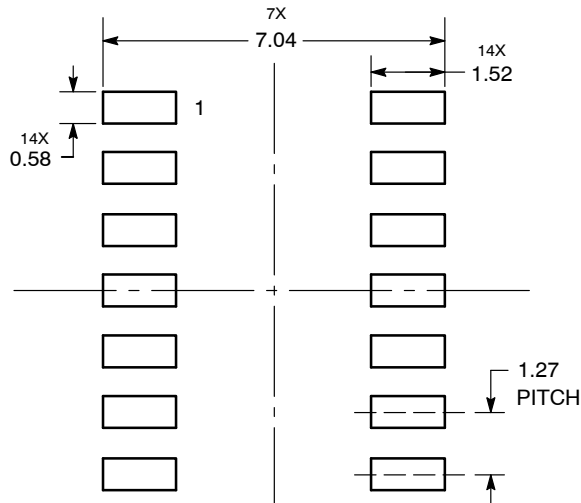


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 8.55        | 8.75 | 0.337     | 0.344 |
| B   | 3.80        | 4.00 | 0.150     | 0.157 |
| C   | 1.35        | 1.75 | 0.054     | 0.068 |
| D   | 0.35        | 0.49 | 0.014     | 0.019 |
| F   | 0.40        | 1.25 | 0.016     | 0.049 |
| G   | 1.27 BSC    |      | 0.050 BSC |       |
| J   | 0.19        | 0.25 | 0.008     | 0.009 |
| K   | 0.10        | 0.25 | 0.004     | 0.009 |
| M   | 0°          | 7°   | 0°        | 7°    |
| P   | 5.80        | 6.20 | 0.228     | 0.244 |
| R   | 0.25        | 0.50 | 0.010     | 0.019 |

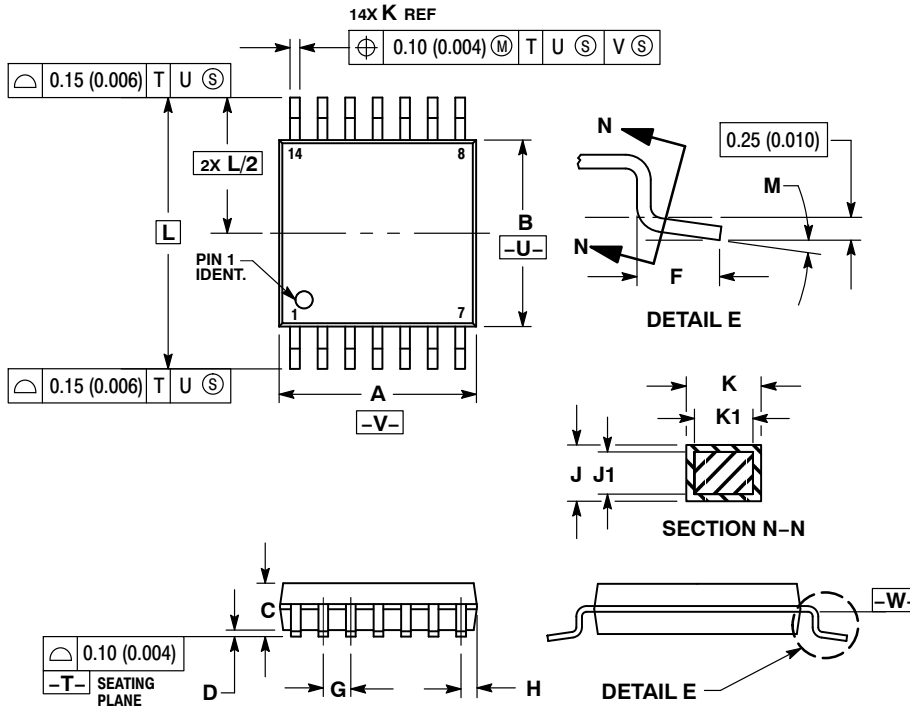
## SOLDERING FOOTPRINT



# MC74LVX14

## PACKAGE DIMENSIONS

TSSOP-14  
DT SUFFIX  
CASE 948G-01  
ISSUE B

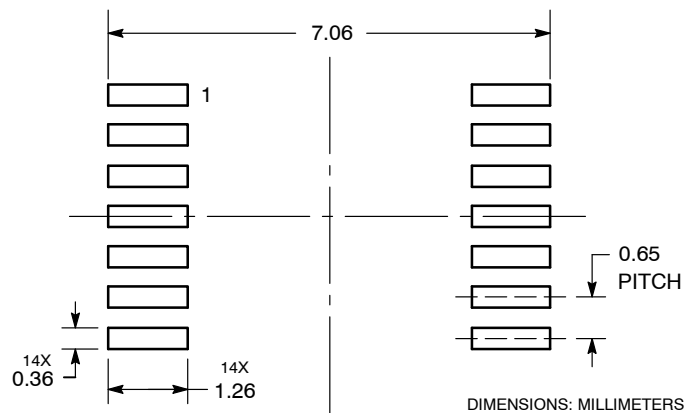


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.90        | 5.10 | 0.193     | 0.200 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 1.20 | ---       | 0.047 |
| D   | 0.05        | 0.15 | 0.002     | 0.006 |
| F   | 0.50        | 0.75 | 0.020     | 0.030 |
| G   | 0.65 BSC    |      | 0.026 BSC |       |
| H   | 0.50        | 0.60 | 0.020     | 0.024 |
| J   | 0.09        | 0.20 | 0.004     | 0.008 |
| J1  | 0.09        | 0.16 | 0.004     | 0.006 |
| K   | 0.19        | 0.30 | 0.007     | 0.012 |
| K1  | 0.19        | 0.25 | 0.007     | 0.010 |
| L   | 6.40 BSC    |      | 0.252 BSC |       |
| M   | 0°          | 8°   | 0°        | 8°    |

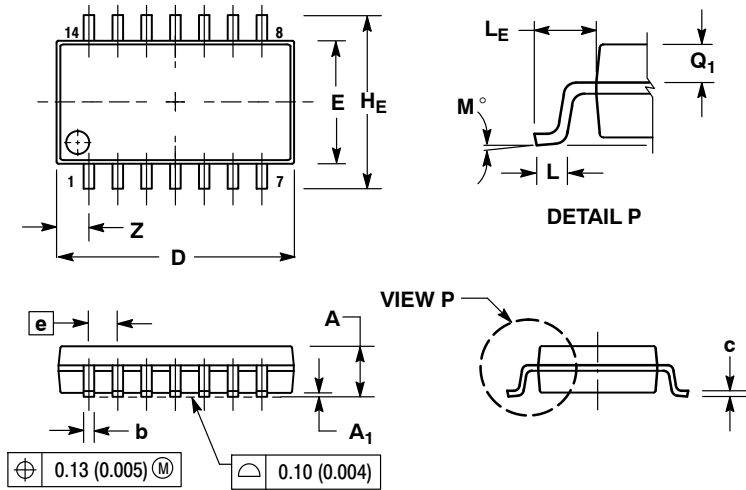
### SOLDERING FOOTPRINT



# MC74LVX14

## PACKAGE DIMENSIONS

SOEIAJ-14  
CASE 965-01  
ISSUE B



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | MIN         | MAX   | MIN       | MAX   |
| A              | ---         | 2.05  | ---       | 0.081 |
| A <sub>1</sub> | 0.05        | 0.20  | 0.002     | 0.008 |
| b              | 0.35        | 0.50  | 0.014     | 0.020 |
| c              | 0.10        | 0.20  | 0.004     | 0.008 |
| D              | 9.90        | 10.50 | 0.390     | 0.413 |
| E              | 5.10        | 5.45  | 0.201     | 0.215 |
| e              | 1.27 BSC    |       | 0.050 BSC |       |
| H <sub>E</sub> | 7.40        | 8.20  | 0.291     | 0.323 |
| L              | 0.50        | 0.85  | 0.020     | 0.033 |
| LE             | 1.10        | 1.50  | 0.043     | 0.059 |
| M              | 0°          | 10°   | 0°        | 10°   |
| Q <sub>1</sub> | 0.70        | 0.90  | 0.028     | 0.035 |
| Z              | ---         | 1.42  | ---       | 0.056 |

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