

# MC74LVX50

## Hex Buffer

The MC74LVX50 is an advanced high speed CMOS buffer fabricated with silicon gate CMOS technology.

The internal circuit is composed of three stages, including a buffered output which provides high noise immunity and stable output. The inputs tolerate voltages up to 7.0 V, allowing the interface of 5.0 V systems to 3.0 V systems.

### Features

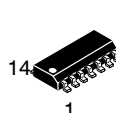
- High Speed:  $t_{PD} = 4.1$  ns (Typ) at  $V_{CC} = 3.3$  V
- Low Power Dissipation:  $I_{CC} = 2$   $\mu$ A (Max) at  $T_A = 25^\circ\text{C}$
- High Noise Immunity:  $V_{NIH} = V_{NIL} = 28\%$   $V_{CC}$
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Designed for 2.0 V to 3.6 V Operating Range
- Low Noise:  $V_{OLP} = 0.5$  V (Max)
- These Devices are Pb-Free and are RoHS Compliant



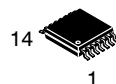
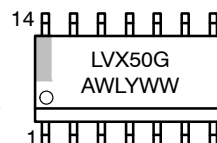
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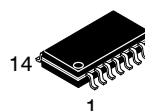
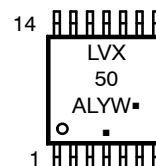
### MARKING DIAGRAMS



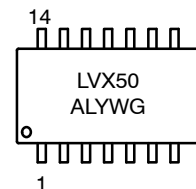
**SOIC-14  
D SUFFIX  
CASE 751A**



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



**SOEIAJ-14  
M SUFFIX  
CASE 965**



LVX50 = 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.

# MC74LVX50

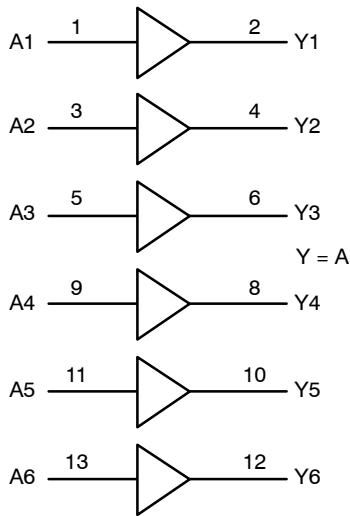


Figure 1. Logic Diagram

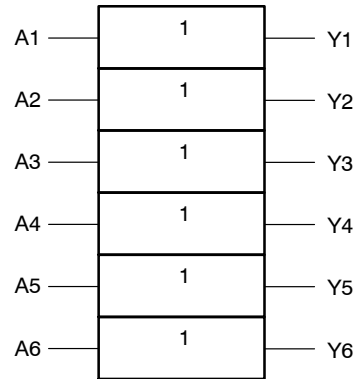
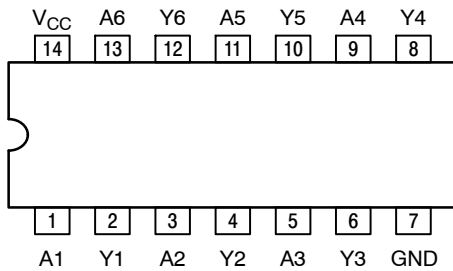


Figure 2. Logic Symbol



14-Lead Pinout (Top View)

FUNCTION TABLE

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

## ORDERING INFORMATION

| Device         | Package                | Shipping†        |
|----------------|------------------------|------------------|
| MC74LVX50DG    | SOIC-14<br>(Pb-Free)   | 55 Units / Rail  |
| MC74LVX50DR2G  | SOIC-14<br>(Pb-Free)   | 2500 Tape & Reel |
| MC74LVX50DTG   | TSSOP-14*              | 96 Units / Rail  |
| MC74LVX50DTR2G | TSSOP-14*              | 2500 Tape & Reel |
| MC74LVX50MG    | SOEIAJ-14<br>(Pb-Free) | 50 Units / Rail  |
| MC74LVX50MELG  | SOEIAJ-14<br>(Pb-Free) | 2000 Tape & Reel |

†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.

# MC74LVX50

## MAXIMUM RATINGS

| Symbol               | Parameter                                                                                                     | Value                          | Unit |
|----------------------|---------------------------------------------------------------------------------------------------------------|--------------------------------|------|
| V <sub>CC</sub>      | DC Supply Voltage                                                                                             | − 0.5 to + 7.0                 | V    |
| V <sub>IN</sub>      | DC Input Voltage                                                                                              | − 0.5 to + 7.0                 | V    |
| V <sub>OUT</sub>     | DC Output Voltage                                                                                             | − 0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>      | DC Input Diode Current<br>V <sub>I</sub> < GND                                                                | − 20                           | mA   |
| I <sub>OK</sub>      | DC Output Diode Current<br>V <sub>O</sub> < GND                                                               | ± 20                           | mA   |
| I <sub>OUT</sub>     | DC Output Sink Current                                                                                        | ± 25                           | mA   |
| I <sub>CC</sub>      | DC Supply Current per Supply Pin                                                                              | ± 50                           | mA   |
| T <sub>STG</sub>     | Storage Temperature Range                                                                                     | − 65 to + 150                  | °C   |
| T <sub>L</sub>       | Lead Temperature, 1 mm from Case for 10 Seconds                                                               | 260                            | °C   |
| T <sub>J</sub>       | Junction Temperature under Bias                                                                               | + 150                          | °C   |
| θ <sub>JA</sub>      | Thermal Resistance<br>(Note 1)<br>SOIC<br>TSSOP                                                               | 125<br>170                     | °C/W |
| MSL                  | Moisture Sensitivity                                                                                          | Level 1                        |      |
| F <sub>R</sub>       | Flammability Rating<br>Oxygen Index: 30% – 35%                                                                | UL 94–V0 @ 0.125 in            |      |
| V <sub>ESD</sub>     | ESD Withstand Voltage<br>Human Body Model (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4) | > 2000<br>> 200<br>2000        | V    |
| I <sub>Latchup</sub> | Latchup Performance<br>Above V <sub>CC</sub> and Below GND at 85°C (Note 5)                                   | ± 300                          | mA   |

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.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
2. Tested to EIA/JESD22–A114–A.
3. Tested to EIA/JESD22–A115–A.
4. Tested to JESD22–C101–A.
5. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol          | Parameter                                                             | Min  | Max             | Unit |
|-----------------|-----------------------------------------------------------------------|------|-----------------|------|
| V <sub>CC</sub> | Supply Voltage                                                        | 2.0  | 3.6             | V    |
| V <sub>I</sub>  | Input Voltage<br>(Note 6)                                             | 0    | 5.5             | V    |
| V <sub>O</sub>  | Output Voltage<br>(HIGH or LOW State)                                 | 0    | V <sub>CC</sub> | V    |
| T <sub>A</sub>  | Operating Free–Air Temperature                                        | − 40 | + 85            | °C   |
| Δt/ΔV           | Input Transition Rise or Fall Rate<br>V <sub>CC</sub> = 3.0 V ± 0.3 V | 0    | 100             | ns/V |

6. Unused inputs may not be left open. All inputs must be tied to a high– or low–logic input voltage level.

NOTE: The θ<sub>JA</sub> of the package is equal to 1/Derating. Higher junction temperatures may affect the expected lifetime of the device per the table and figure below.

# MC74LVX50

## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter                                                                            | Test Conditions                                                                 | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C |            |                    | T <sub>A</sub> ≤ 85°C |                    | Unit |
|-----------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------|-----------------------|------------|--------------------|-----------------------|--------------------|------|
|                 |                                                                                      |                                                                                 |                        | Min                   | Typ        | Max                | Min                   | Max                |      |
| V <sub>IH</sub> | High-Level Input Voltage                                                             |                                                                                 | 2.0<br>3.0<br>3.6      | 1.5<br>2.0<br>2.4     |            |                    | 1.5<br>2.0<br>2.4     |                    | V    |
| V <sub>IL</sub> | Low-Level Input Voltage                                                              |                                                                                 | 2.0<br>3.0<br>3.6      |                       |            | 0.5<br>0.8<br>0.8  |                       | 0.5<br>0.8<br>0.8  | V    |
| V <sub>OH</sub> | High-Level Output Voltage<br>(V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ) | I <sub>OH</sub> = -50 µA<br>I <sub>OH</sub> = -50 µA<br>I <sub>OH</sub> = -4 mA | 2.0<br>3.0<br>3.0      | 1.9<br>2.9<br>2.58    | 2.0<br>3.0 |                    | 1.9<br>2.9<br>2.48    |                    | V    |
| V <sub>OL</sub> | Low-Level Output Voltage<br>(V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> )  | I <sub>OL</sub> = 50 µA<br>I <sub>OL</sub> = 50 µA<br>I <sub>OL</sub> = 4 mA    | 2.0<br>3.0<br>3.0      |                       | 0.0<br>0.0 | 0.1<br>0.1<br>0.36 |                       | 0.1<br>0.1<br>0.44 | V    |
| I <sub>IN</sub> | Input Leakage Current                                                                | V <sub>IN</sub> = 5.5 V or GND                                                  | 0 to<br>3.6            |                       |            | ±0.1               |                       | ±1.0               | µA   |
| I <sub>CC</sub> | Quiescent Supply Current                                                             | V <sub>IN</sub> = V <sub>CC</sub> or GND                                        | 3.6                    |                       |            | 2.0                |                       | 20.0               | µA   |

## AC ELECTRICAL CHARACTERISTICS Input t<sub>r</sub> = t<sub>f</sub> = 3.0 ns

| Symbol                                 | Parameter                              | Test Conditions                                                                       | T <sub>A</sub> = 25°C |            |              | T <sub>A</sub> ≤ 85°C |              | Unit |
|----------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------|-----------------------|------------|--------------|-----------------------|--------------|------|
|                                        |                                        |                                                                                       | Min                   | Typ        | Max          | Min                   | Max          |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Propagation Delay,<br>Input A to Y     | V <sub>CC</sub> = 2.7 V      C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF         |                       | 5.4<br>7.9 | 10.1<br>13.6 | 1.0<br>1.0            | 12.5<br>16.0 | ns   |
|                                        |                                        | V <sub>CC</sub> = 3.3 V ± 0.3 V      C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |                       | 4.1<br>6.6 | 6.2<br>9.7   | 1.0<br>1.0            | 7.5<br>11.5  |      |
| t <sub>OSSL</sub><br>t <sub>OSLH</sub> | Output-to-Output Skew<br>(Note 7)      | V <sub>CC</sub> = 2.7 V      C <sub>L</sub> = 50 pF                                   |                       |            | 1.5          |                       | 1.5          | ns   |
|                                        |                                        | V <sub>CC</sub> = 3.3 V ±0.3V      C <sub>L</sub> = 50 pF                             |                       |            | 1.5          |                       | 1.5          |      |
| C <sub>IN</sub>                        | Input Capacitance                      |                                                                                       |                       | 4          | 10           |                       | 10           | pF   |
| C <sub>PD</sub>                        | Power Dissipation Capacitance (Note 8) | Typical @ 25°C, V <sub>CC</sub> = 3.3 V                                               |                       |            |              |                       |              | pF   |
|                                        |                                        | 15                                                                                    |                       |            |              |                       |              |      |

7. 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<sub>OSSL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>); parameter guaranteed by design.
8. 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<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

## NOISE CHARACTERISTICS Input t<sub>r</sub> = t<sub>f</sub> = 3.0ns, C<sub>L</sub> = 50pF, V<sub>CC</sub> = 3.3 V

| Symbol           | Characteristic                               | T <sub>A</sub> = 25°C |      | Unit |
|------------------|----------------------------------------------|-----------------------|------|------|
|                  |                                              | Typ                   | Max  |      |
| V <sub>OLP</sub> | Quiet Output Maximum Dynamic V <sub>OL</sub> | 0.3                   | 0.5  | V    |
| V <sub>OLV</sub> | Quiet Output Minimum Dynamic V <sub>OL</sub> | -0.3                  | -0.5 | V    |
| V <sub>IHD</sub> | Minimum High Level Dynamic Input Voltage     |                       | 2.0  | V    |
| V <sub>ILD</sub> | Maximum Low Level Dynamic Input Voltage      |                       | 0.8  | V    |

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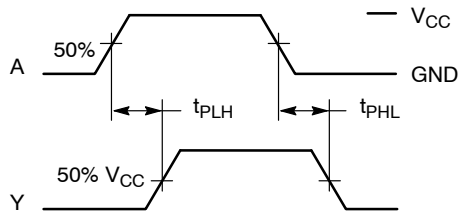
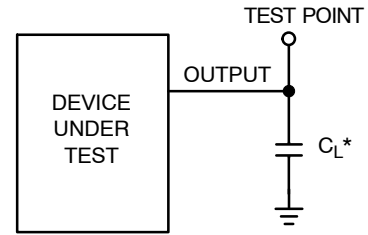


Figure 3. Switching Waveforms



\*Includes all probe and jig capacitance

Figure 4. Test Circuit

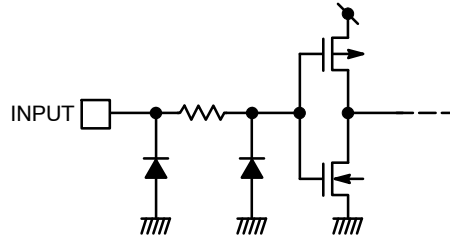


Figure 5. Input Equivalent Circuit

## EMBOSSED CARRIER DIMENSIONS (See Notes 9 and 10)

| Tape Size | B <sub>1</sub> Max  | D                                    | D <sub>1</sub>            | E                                     | F                                      | K                          | P                                                                                                                        | P <sub>0</sub>                       | P <sub>2</sub>                       | R                | T                 | W                                     |
|-----------|---------------------|--------------------------------------|---------------------------|---------------------------------------|----------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------|------------------|-------------------|---------------------------------------|
| 8 mm      | 4.35 mm<br>(0.179") | 1.5 mm<br>+ 0.1<br>- 0.0<br>(0.059") | 1.0 mm<br>Min<br>(0.179") | 1.75 mm<br>±0.1<br>(0.069<br>±0.004") | 3.5 mm<br>±0.5<br>(1.38<br>±0.002")    | 2.4 mm<br>Max<br>(0.094")  | 4.0 mm<br>±0.10<br>(0.157<br>±0.004")                                                                                    | 4.0 mm<br>±0.1<br>(0.157<br>±0.004") | 2.0 mm<br>±0.1<br>(0.079<br>±0.004") | 25 mm<br>(0.98") | 0.6 mm<br>(0.024) | 8.3 mm<br>(0.327)                     |
| 12 mm     | 8.2 mm<br>(0.323")  | +0.004<br>- 0.0                      | 1.5 mm<br>Min<br>(0.060)  |                                       | 5.5 mm<br>±0.5<br>(0.217<br>±0.002")   | 6.4 mm<br>Max<br>(0.252")  | 4.0 mm<br>±0.10<br>(0.157<br>±0.004")<br>8.0 mm<br>±0.10<br>(0.315<br>±0.004")                                           |                                      |                                      | 30 mm<br>(1.18") |                   | 12.0 mm<br>±0.3<br>(0.470<br>±0.012") |
| 16 mm     | 12.1 mm<br>(0.476") |                                      |                           |                                       | 7.5 mm<br>±0.10<br>(0.295<br>±0.004")  | 7.9 mm<br>Max<br>(0.311")  | 4.0 mm<br>±0.10<br>(0.157<br>±0.004")<br>8.0 mm<br>±0.10<br>(0.315<br>±0.004")<br>12.0 mm<br>±0.10<br>(0.472<br>±0.004") |                                      |                                      |                  |                   | 16.3 mm<br>(0.642)                    |
| 24 mm     | 20.1 mm<br>(0.791") |                                      |                           |                                       | 11.5 mm<br>±0.10<br>(0.453<br>±0.004") | 11.9 mm<br>Max<br>(0.468") | 16.0 mm<br>±0.10<br>(0.63<br>±0.004")                                                                                    |                                      |                                      |                  |                   | 24.3 mm<br>(0.957)                    |

9. Metric Dimensions Govern—English are in parentheses for reference only.

10. A<sub>0</sub>, B<sub>0</sub>, and K<sub>0</sub> are determined by component size. The clearance between the components and the cavity must be within 0.05 mm min to 0.50 mm max. The component cannot rotate more than 10° within the determined cavity

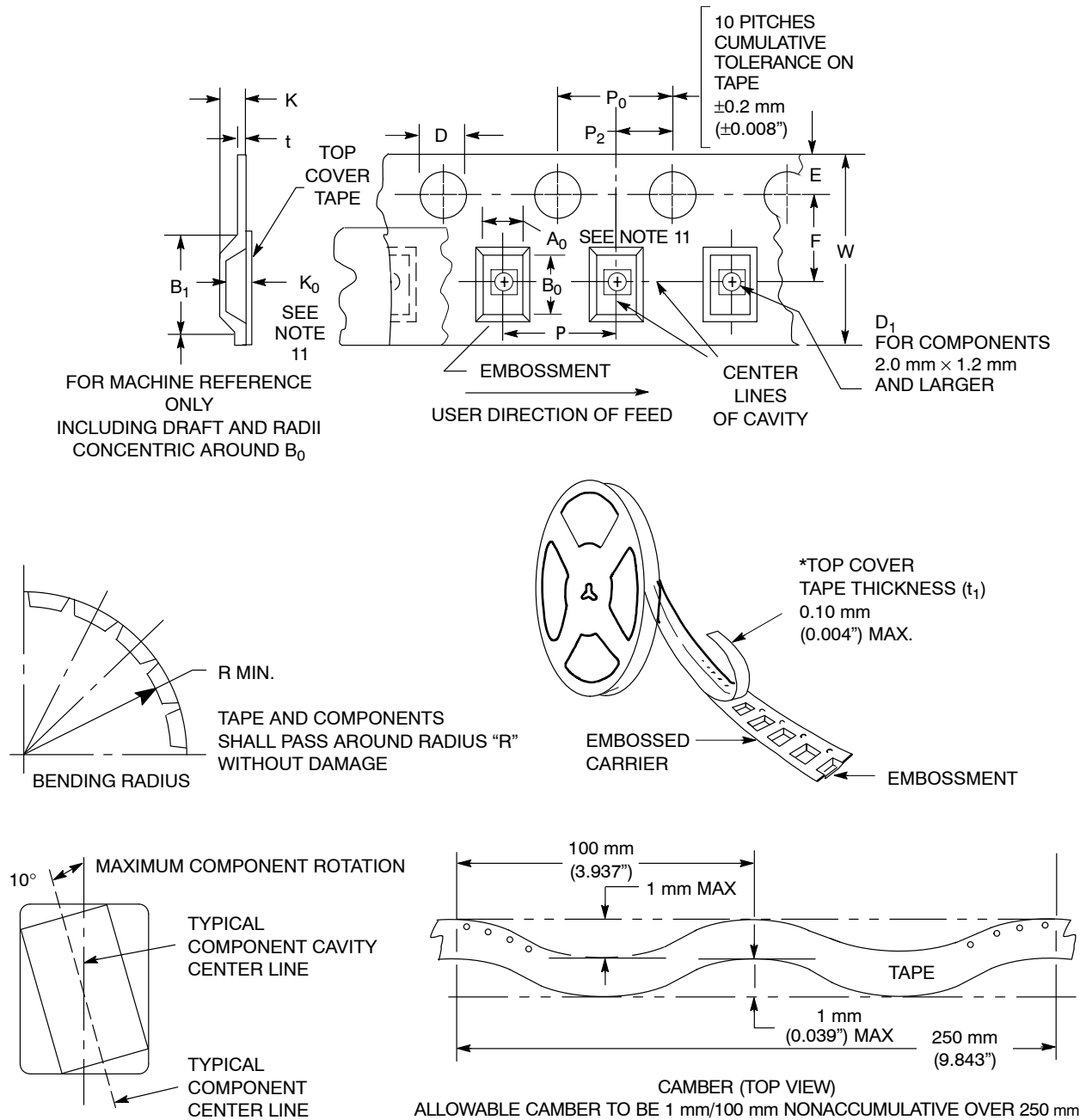


Figure 6. Carrier Tape Specifications

# MC74LVX50

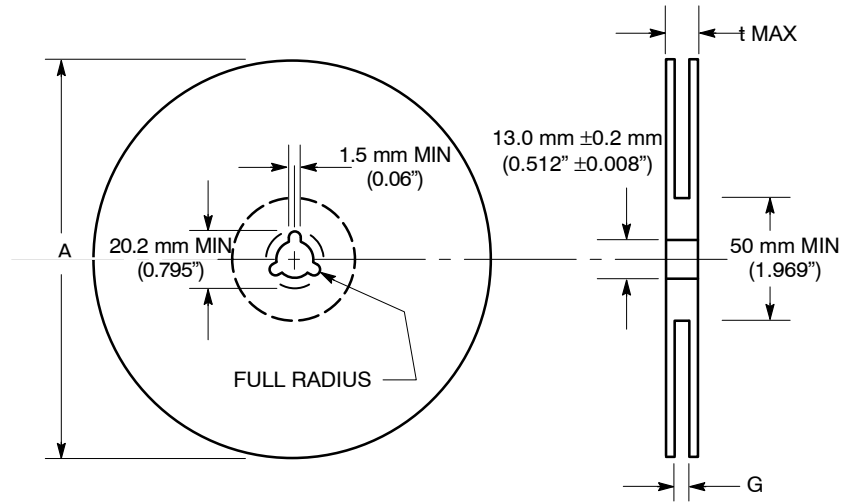


Figure 7. Reel Dimensions

## REEL DIMENSIONS

| Tape Size | T&R Suffix | A Max               | G                                                  | t Max               |
|-----------|------------|---------------------|----------------------------------------------------|---------------------|
| 8 mm      | T1, T2     | 178 mm<br>(7")      | 8.4 mm, +1.5 mm, -0.0<br>(0.33" + 0.059", -0.00)   | 14.4 mm<br>(0.56")  |
| 8 mm      | T3, T4     | 330 mm<br>(13")     | 8.4 mm, +1.5 mm, -0.0<br>(0.33" + 0.059", -0.00)   | 14.4 mm<br>(0.56")  |
| 12 mm     | R2         | 330 mm<br>(13")     | 12.4 mm, +2.0 mm, -0.0<br>(0.49" + 0.079", -0.00)  | 18.4 mm<br>(0.72")  |
| 16 mm     | R2         | 360 mm<br>(14.173") | 16.4 mm, +2.0 mm, -0.0<br>(0.646" + 0.078", -0.00) | 22.4 mm<br>(0.882") |
| 24 mm     | R2         | 360 mm<br>(14.173") | 24.4 mm, +2.0 mm, -0.0<br>(0.961" + 0.078", -0.00) | 30.4 mm<br>(1.197") |

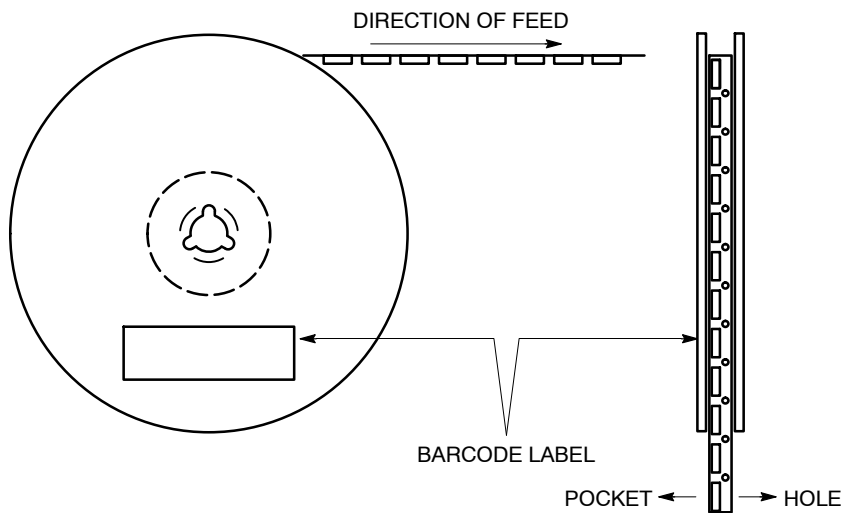


Figure 8. Reel Winding Direction

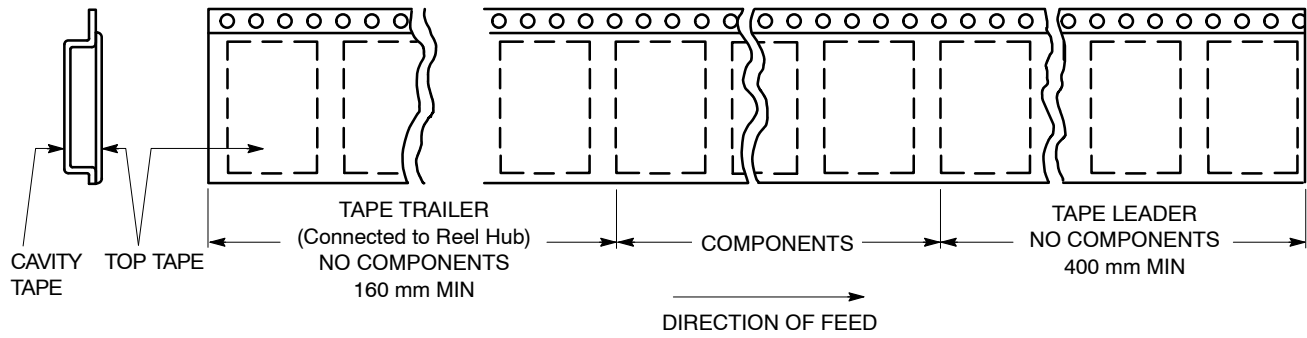


Figure 9. Tape Ends for Finished Goods

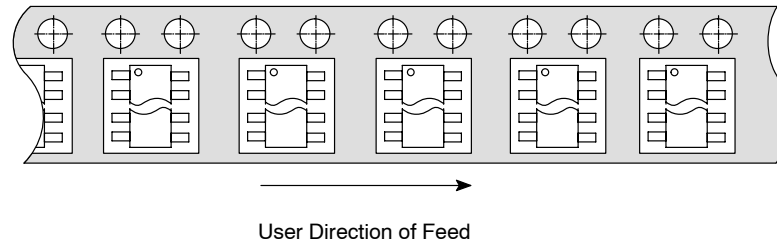


Figure 10. TSSOP and SOIC R2 Reel Configuration/Orientation

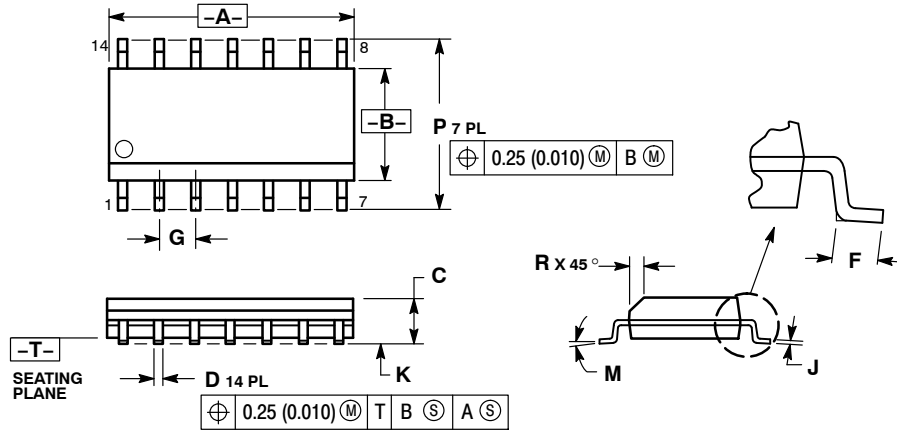
**TAPE UTILIZATION BY PACKAGE**

| Tape Size | SOIC                   | TSSOP            | QFN              | SC88A / SOT-353<br>SC88/SOT-363 |
|-----------|------------------------|------------------|------------------|---------------------------------|
| 8 mm      |                        |                  |                  | 5-, 6-Lead                      |
| 12 mm     | 8-Lead                 | 8-, 14-, 16-Lead | 8-, 14-, 16-Lead |                                 |
| 16 mm     | 14-, 16-Lead           | 20-, 24-Lead     | 20-, 24-Lead     |                                 |
| 24 mm     | 18-, 20-, 24-, 28-Lead | 48-, 56-Lead     | 48-, 56-Lead     |                                 |

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## PACKAGE DIMENSIONS

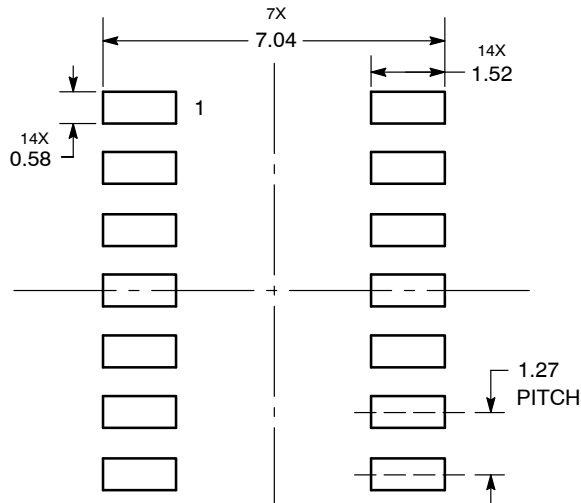
SOIC-14  
D SUFFIX  
CASE 751A-03  
ISSUE J



- 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



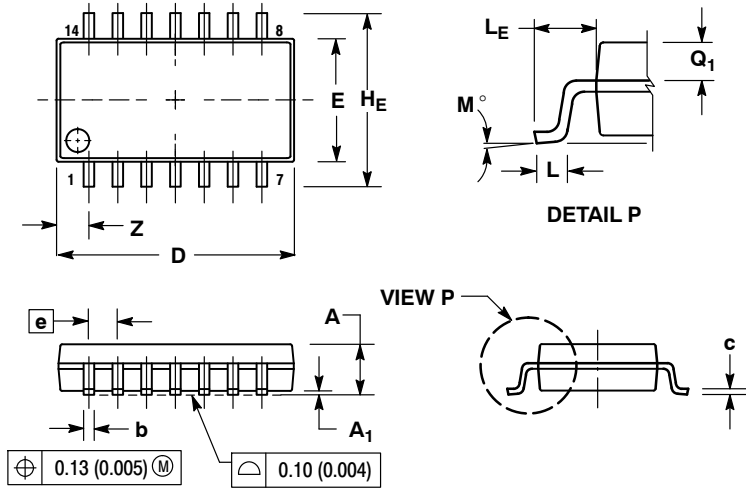
DIMENSIONS: MILLIMETERS



# MC74LVX50

## 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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