

## 74LCX126

### Low Voltage Quad Buffer with 5V Tolerant Inputs and Outputs

#### General Description

The LCX126 contains four independent non-inverting buffers with 3-STATE outputs. Each output is disabled when the associated output-enable (OE) input is LOW. The inputs tolerate voltages up to 7V allowing the interface of 5V systems to 3V systems.

The 74LCX126 is fabricated with an 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
- 5.5 ns  $t_{PD}$  max ( $V_{CC} = 3.3V$ ), 10  $\mu A$   $I_{CC}$  max
- Power down high impedance inputs and outputs
- Supports live insertion/withdrawal (Note 1)
- $\pm 24$  mA output drive ( $V_{CC} = 3.0V$ )
- Implements patented noise/EMI reduction circuitry
- Latch-up performance exceeds JEDEC 78 conditions
- ESD performance:
  - Human body model > 2000V
  - Machine model > 100V
- Leadless Pb-Free DQFN package

**Note 1:** To ensure the high-impedance state during power up or down, OE should be tied to GND through a pull-up resistor: the minimum value or the resistor is determined by the current-sourcing capability of the driver.

#### Ordering Code:

| Order Number                | Package Number | Package Description                                                                                 |
|-----------------------------|----------------|-----------------------------------------------------------------------------------------------------|
| 74LCX126M                   | M14A           | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow                        |
| 74LCX126SJ                  | M14D           | Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide                               |
| 74LCX126BQX<br>(Note 2)     | MLP014A        | Pb-Free 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm |
| 74LCX126MTC                 | MTC14          | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide                         |
| 74LCX126MTCX_NL<br>(Note 3) | MTC14          | Pb-Free 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide                 |

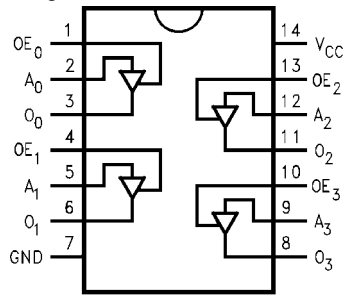
Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.  
Pb-Free package per JEDEC J-STD-020B.

**Note 2:** DQFN package available in Tape and Reel only.

**Note 3:** "\_NL" indicates Pb-Free package (per JEDEC J-STD-020B). Please use order number as indicated.

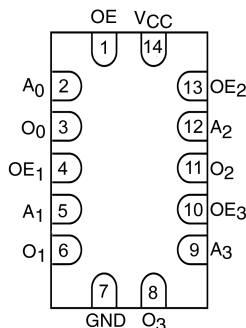
# Connection Diagrams

Pin Assignments for SOIC, SOP, and TSSOP



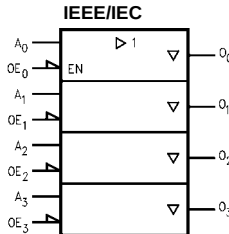
(Top View)

Pad Assignments for DQFN



(Top Through View)

# Logic Symbol



# Pin Descriptions

| Pin Names | Description          |
|-----------|----------------------|
| $A_n$     | Inputs               |
| $OE_n$    | Output Enable Inputs |
| $O_n$     | Outputs              |

# Truth Table

| Inputs |       | Output |
|--------|-------|--------|
| $OE_n$ | $A_n$ | $O_n$  |
| H      | L     | L      |
| H      | H     | H      |
| L      | X     | Z      |

H = HIGH Voltage Level  
L = LOW Voltage Level  
Z = High Impedance  
X = Immaterial

| Absolute Maximum Ratings <sup>(Note 4)</sup> |                                  |                               |                                      |       |
|----------------------------------------------|----------------------------------|-------------------------------|--------------------------------------|-------|
| Symbol                                       | Parameter                        | Value                         | Conditions                           | Units |
| V <sub>CC</sub>                              | Supply Voltage                   | −0.5 to +7.0                  |                                      | V     |
| V <sub>I</sub>                               | DC Input Voltage                 | −0.5 to +7.0                  |                                      | V     |
| V <sub>O</sub>                               | DC Output Voltage                | −0.5 to +7.0                  | Output in 3-STATE                    | V     |
|                                              |                                  | −0.5 to V <sub>CC</sub> + 0.5 | Output in HIGH or LOW State (Note 5) | V     |
| I <sub>IK</sub>                              | DC Input Diode Current           | −50                           | V <sub>I</sub> < GND                 | mA    |
| I <sub>OK</sub>                              | DC Output Diode Current          | −50                           | V <sub>O</sub> < GND                 | mA    |
|                                              |                                  | +50                           | V <sub>O</sub> > V <sub>CC</sub>     |       |
| I <sub>O</sub>                               | DC Output Source/Sink Current    | ±50                           |                                      | mA    |
| I <sub>CC</sub>                              | DC Supply Current per Supply Pin | ±100                          |                                      | mA    |
| I <sub>GND</sub>                             | DC Ground Current per Ground Pin | ±100                          |                                      | mA    |
| T <sub>STG</sub>                             | Storage Temperature              | −65 to +150                   |                                      | °C    |

| Recommended Operating Conditions (Note 6) |                                                                      |                                                                                                 |     |                  |    |
|-------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----|------------------|----|
| Symbol                                    | Parameter                                                            | Min                                                                                             | Max | Units            |    |
| V <sub>CC</sub>                           | Supply Voltage                                                       | Operating                                                                                       | 2.0 | 3.6              | V  |
|                                           |                                                                      | Data Retention                                                                                  | 1.5 | 3.6              |    |
| V <sub>I</sub>                            | Input Voltage                                                        | 0                                                                                               | 5.5 | V                |    |
| V <sub>O</sub>                            | Output Voltage                                                       | HIGH or LOW State                                                                               | 0   | V <sub>CC</sub>  | V  |
|                                           |                                                                      | 3-STATE                                                                                         | 0   | 5.5              |    |
| I <sub>OH</sub> /I <sub>OL</sub>          | Output Current                                                       | V <sub>CC</sub> = 3.0V – 3.6V<br>V <sub>CC</sub> = 2.7V – 3.0V<br>V <sub>CC</sub> = 2.3V – 2.7V |     | ±24<br>±12<br>±8 | mA |
| T <sub>A</sub>                            | Free-Air Operating Temperature                                       | −40                                                                                             | 85  | °C               |    |
| Δt/ΔV                                     | Input Edge Rate, V <sub>IN</sub> = 0.8V–2.0V, V <sub>CC</sub> = 3.0V | 0                                                                                               | 10  | ns/V             |    |

**Note 4:** 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 5:** I<sub>O</sub> Absolute Maximum Rating must be observed.

**Note 6:** Unused inputs or I/Os must be held HIGH or LOW. They may not float.

| DC Electrical Characteristics |                           |                                                                                  |                        |                                 |      |       |
|-------------------------------|---------------------------|----------------------------------------------------------------------------------|------------------------|---------------------------------|------|-------|
| Symbol                        | Parameter                 | Conditions                                                                       | V <sub>CC</sub><br>(V) | T <sub>A</sub> = −40°C to +85°C |      | Units |
|                               |                           |                                                                                  |                        | Min                             | Max  |       |
| V <sub>IH</sub>               | HIGH Level Input Voltage  |                                                                                  | 2.3 – 2.7              | 1.7                             |      | V     |
|                               |                           |                                                                                  | 2.7 – 3.6              | 2.0                             |      |       |
| V <sub>IL</sub>               | LOW Level Input Voltage   |                                                                                  | 2.3 – 2.7              |                                 | 0.7  | V     |
|                               |                           |                                                                                  | 2.7 – 3.6              |                                 | 0.8  |       |
| V <sub>OH</sub>               | HIGH Level Output Voltage | I <sub>OH</sub> = −100 μA                                                        | 2.3 – 3.6              | V <sub>CC</sub> − 0.2           |      | V     |
|                               |                           | I <sub>OH</sub> = −8 mA                                                          | 2.3                    | 1.8                             |      |       |
|                               |                           | I <sub>OH</sub> = −12 mA                                                         | 2.7                    | 2.2                             |      |       |
|                               |                           | I <sub>OH</sub> = −18 mA                                                         | 3.0                    | 2.4                             |      |       |
|                               |                           | I <sub>OH</sub> = −24 mA                                                         | 3.0                    | 2.2                             |      |       |
| V <sub>OL</sub>               | LOW Level Output Voltage  | I <sub>OL</sub> = 100 μA                                                         | 2.3 – 3.6              |                                 | 0.2  | V     |
|                               |                           | I <sub>OL</sub> = 8mA                                                            | 2.3                    |                                 | 0.6  |       |
|                               |                           | I <sub>OL</sub> = 12 mA                                                          | 2.7                    |                                 | 0.4  |       |
|                               |                           | I <sub>OL</sub> = 16 mA                                                          | 3.0                    |                                 | 0.4  |       |
|                               |                           | I <sub>OL</sub> = 24 mA                                                          | 3.0                    |                                 | 0.55 |       |
| I <sub>I</sub>                | Input Leakage Current     | 0 ≤ V <sub>I</sub> ≤ 5.5V                                                        | 2.3 – 3.6              |                                 | ±5.0 | μA    |
| I <sub>OZ</sub>               | 3-STATE Output Leakage    | 0 ≤ V <sub>O</sub> ≤ 5.5V<br>V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> | 2.3 – 3.6              |                                 | ±5.0 | μA    |
| I <sub>OFF</sub>              | Power-Off Leakage Current | V <sub>I</sub> or V <sub>O</sub> = 5.5V                                          | 0                      |                                 | 10   | μA    |

## DC Electrical Characteristics (Continued)

| Symbol           | Parameter                             | Conditions                                             | V <sub>CC</sub><br>(V) | T <sub>A</sub> = -40°C to +85°C |     | Units |
|------------------|---------------------------------------|--------------------------------------------------------|------------------------|---------------------------------|-----|-------|
|                  |                                       |                                                        |                        | Min                             | Max |       |
| I <sub>CC</sub>  | Quiescent Supply Current              | V <sub>I</sub> = V <sub>CC</sub> or GND                | 2.3 – 3.6              |                                 | 10  | μA    |
|                  |                                       | 3.6V ≤ V <sub>I</sub> , V <sub>O</sub> ≤ 5.5V (Note 7) | 2.3 – 3.6              |                                 | ±10 |       |
| ΔI <sub>CC</sub> | Increase in I <sub>CC</sub> per Input | V <sub>IH</sub> = V <sub>CC</sub> – 0.6V               | 2.3 – 3.6              |                                 | 500 | μA    |

Note 7: Outputs disabled or 3-STATE only.

## AC Electrical Characteristics

| Symbol            | Parameter                      | T <sub>A</sub> = -40°C to +85°C, R <sub>L</sub> = 500Ω |     |                        |     |                               |     | Units |
|-------------------|--------------------------------|--------------------------------------------------------|-----|------------------------|-----|-------------------------------|-----|-------|
|                   |                                | V <sub>CC</sub> = 3.3V ± 0.3V                          |     | V <sub>CC</sub> = 2.7V |     | V <sub>CC</sub> = 2.5V ± 0.2V |     |       |
|                   |                                | C <sub>L</sub> = 50 pF                                 |     | C <sub>L</sub> = 50 pF |     | C <sub>L</sub> = 30 pF        |     |       |
|                   |                                | Min                                                    | Max | Min                    | Max | Min                           | Max |       |
| t <sub>PHL</sub>  | Propagation Delay              | 1.5                                                    | 5.5 | 1.5                    | 6.0 | 1.5                           | 6.6 | ns    |
| t <sub>PLH</sub>  |                                | 1.5                                                    | 5.5 | 1.5                    | 6.0 | 1.5                           | 6.6 |       |
| t <sub>PZL</sub>  | Output Enable Time             | 1.5                                                    | 6.0 | 1.5                    | 7.0 | 1.5                           | 7.8 | ns    |
| t <sub>PZH</sub>  |                                | 1.5                                                    | 6.0 | 1.5                    | 7.0 | 1.5                           | 7.8 |       |
| t <sub>PLZ</sub>  | Output Disable Time            | 1.5                                                    | 5.5 | 1.5                    | 6.5 | 1.5                           | 6.6 | ns    |
| t <sub>PHZ</sub>  |                                | 1.5                                                    | 5.5 | 1.5                    | 6.5 | 1.5                           | 6.6 |       |
| t <sub>OSHL</sub> | Output to Output Skew (Note 8) |                                                        | 1.0 |                        |     |                               |     | ns    |
| t <sub>OSLH</sub> |                                |                                                        | 1.0 |                        |     |                               |     |       |

Note 8: 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>OSHL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>).

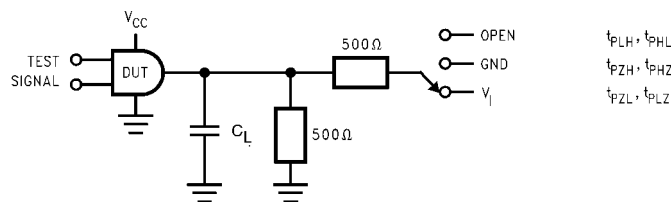
## Dynamic Switching Characteristics

| Symbol           | Parameter                                   | Conditions                                                           | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C | Units |
|------------------|---------------------------------------------|----------------------------------------------------------------------|------------------------|-----------------------|-------|
|                  |                                             |                                                                      |                        | Typical               |       |
| V <sub>OLP</sub> | Quiet Output Dynamic Peak V <sub>OL</sub>   | C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V | 3.3                    | 0.8                   | V     |
|                  |                                             | C <sub>L</sub> = 30 pF, V <sub>IH</sub> = 2.5V, V <sub>IL</sub> = 0V | 2.5                    | 0.6                   |       |
| V <sub>OLV</sub> | Quiet Output Dynamic Valley V <sub>OL</sub> | C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V | 3.3                    | -0.8                  | V     |
|                  |                                             | C <sub>L</sub> = 30 pF, V <sub>IH</sub> = 2.5V, V <sub>IL</sub> = 0V | 2.5                    | -0.6                  |       |

## Capacitance

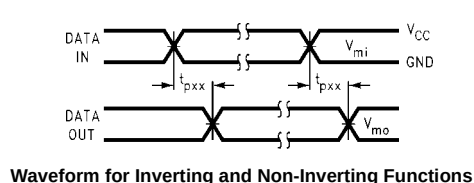
| Symbol           | Parameter                     | Conditions                                                                  | Typical | Units |
|------------------|-------------------------------|-----------------------------------------------------------------------------|---------|-------|
| C <sub>IN</sub>  | Input Capacitance             | V <sub>CC</sub> = Open, V <sub>I</sub> = 0V or V <sub>CC</sub>              | 7       | pF    |
| C <sub>OUT</sub> | Output Capacitance            | V <sub>CC</sub> = 3.3V, V <sub>I</sub> = 0V or V <sub>CC</sub>              | 8       | pF    |
| C <sub>PD</sub>  | Power Dissipation Capacitance | V <sub>CC</sub> = 3.3V, V <sub>I</sub> = 0V or V <sub>CC</sub> , f = 10 MHz | 25      | pF    |

# AC Loading and Waveforms Generic for LCX Family

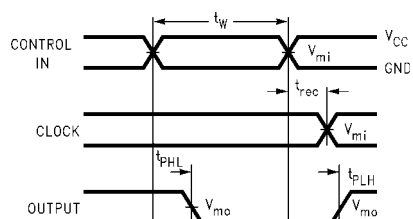


**FIGURE 1. AC Test Circuit**  
( $C_L$  includes probe and jig capacitance)

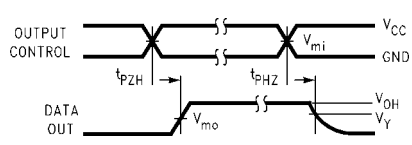
| Test                  | Switch                                                                        |
|-----------------------|-------------------------------------------------------------------------------|
| $t_{PLH}$ , $t_{PHL}$ | Open                                                          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



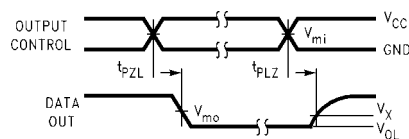
**Waveform for Inverting and Non-Inverting Functions**



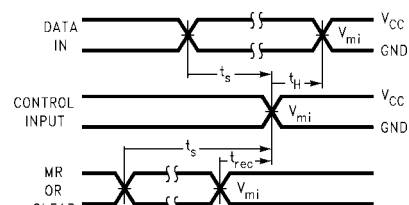
**Propagation Delay, Pulse Width and  $t_{rec}$  Waveforms**



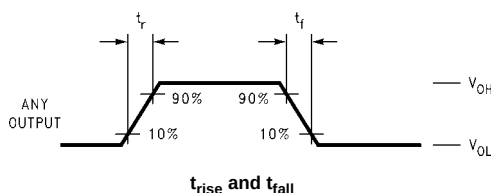
**3-STATE Output High Enable and Disable Times for Logic**



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



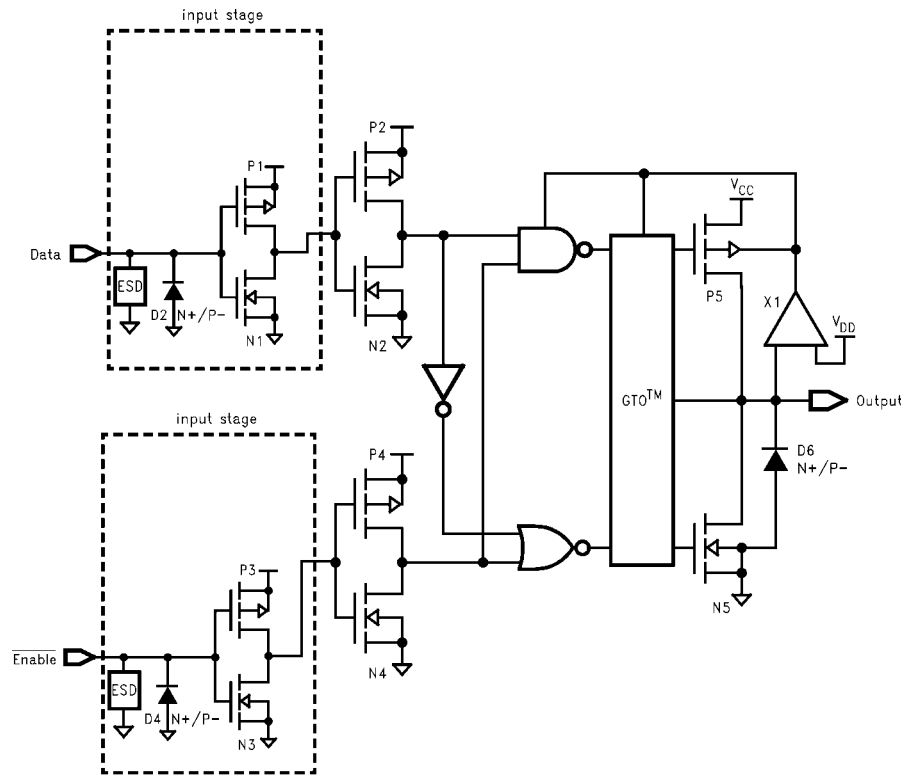
**Setup Time, Hold Time and Recovery Time for Logic**



**FIGURE 2. Waveforms**  
(Input Pulse Characteristics;  $f = 1\text{MHz}$ ,  $t_r = t_f = 3\text{ns}$ )

| 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

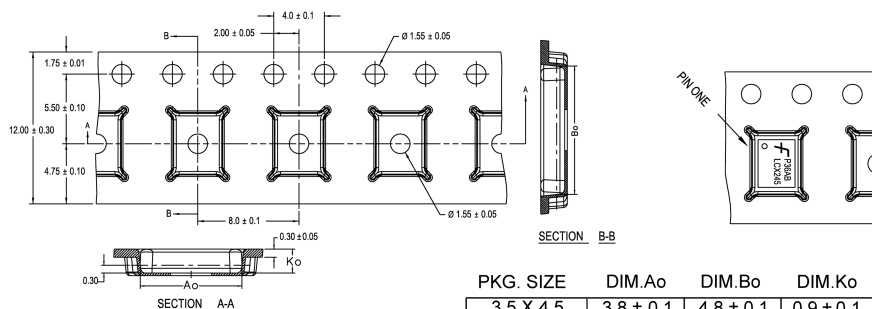


## Tape and Reel Specification

### Tape Format for DQFN

| Package Designator | Tape Section       | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| BQX                | Leader (Start End) | 125 (typ)       | Empty         | Sealed            |
|                    | Carrier            | 2500/3000       | Filled        | Sealed            |
|                    | Trailer (Hub End)  | 75 (typ)        | Empty         | Sealed            |

### TAPE DIMENSIONS inches (millimeters)



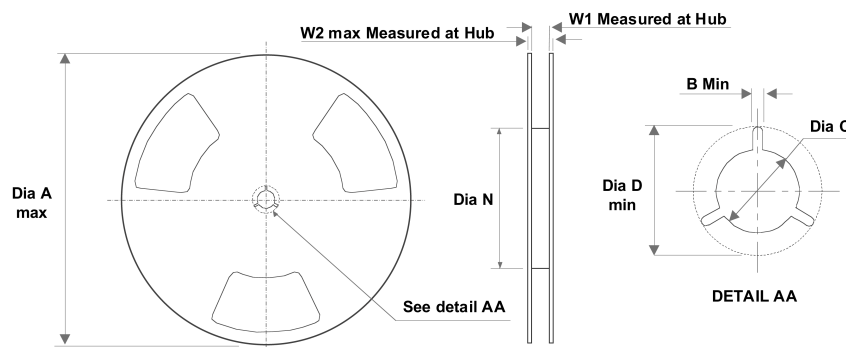
| PKG. SIZE | DIM.Ao    | DIM.Bo    | DIM.Ko    |
|-----------|-----------|-----------|-----------|
| 3.5 X 4.5 | 3.8 ± 0.1 | 4.8 ± 0.1 | 0.9 ± 0.1 |
| 3.0 X 3.0 | 3.3 ± 0.1 | 3.3 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 4.5 | 2.8 ± 0.1 | 4.8 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 3.5 | 2.8 ± 0.1 | 3.8 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 3.0 | 2.8 ± 0.1 | 3.3 ± 0.1 | 0.9 ± 0.1 |
| 2.5 X 2.5 | 2.8 ± 0.1 | 2.8 ± 0.1 | 0.9 ± 0.1 |

DIMENSIONS ARE IN MILLIMETERS

NOTES: unless otherwise specified

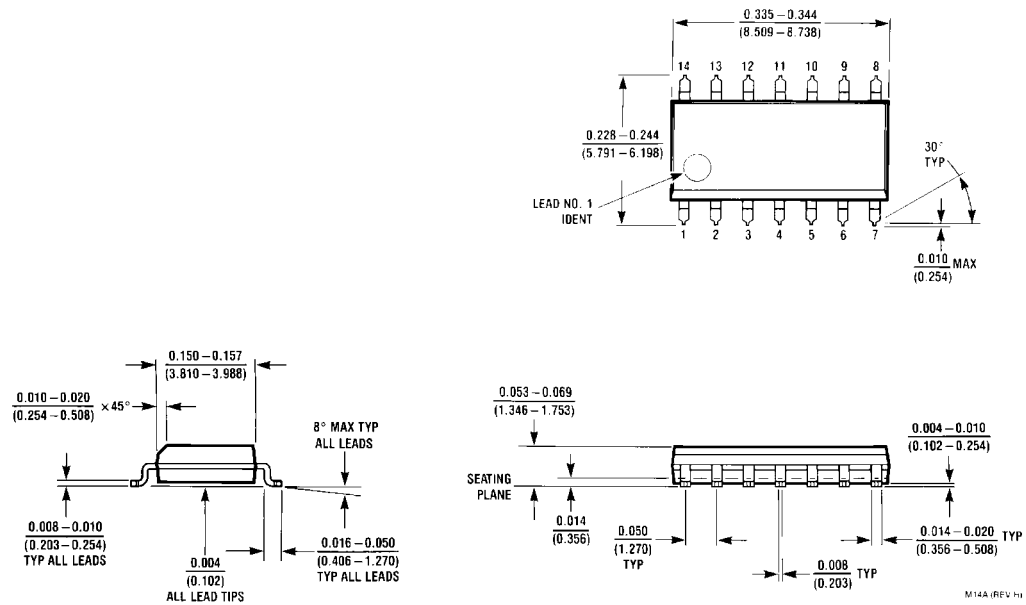
1. Cumulative pitch for feeding holes and cavities (chip pockets) not to exceed 0.008[0.20] over 10 pitch span.
2. Smallest allowable bending radius.
3. Thru hole inside cavity is centered within cavity.
4. Tolerance is  $\pm 0.002[0.05]$  for these dimensions on all 12mm tapes.
5. Ao and Bo measured on a plane 0.120[0.30] above the bottom of the pocket.
6. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
7. Pocket position relative to sprocket hole measured as true position of pocket. Not pocket hole.
8. Controlling dimension is millimeter. Dimension in inches rounded.

### REEL DIMENSIONS Inches (millimeters)



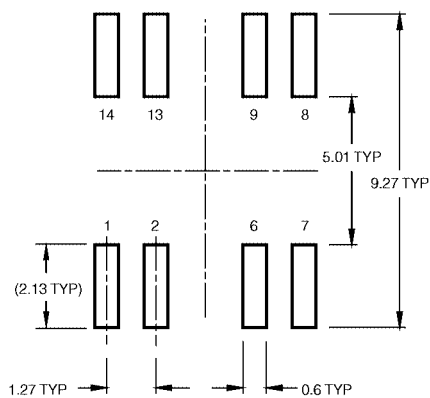
| Tape Size | A             | B               | C                | D                | N              | W1              | W2              |
|-----------|---------------|-----------------|------------------|------------------|----------------|-----------------|-----------------|
| 12mm      | 13.0<br>(330) | 0.059<br>(1.50) | 0.512<br>(13.00) | 0.795<br>(20.20) | 7.008<br>(178) | 0.488<br>(12.4) | 0.724<br>(18.4) |

# Physical Dimensions inches (millimeters) unless otherwise noted

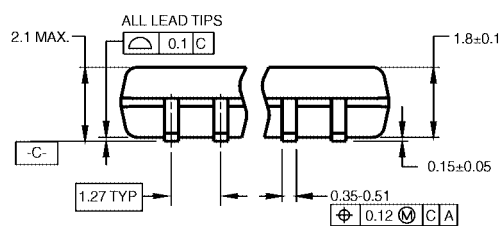


14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow  
Package Number M14A

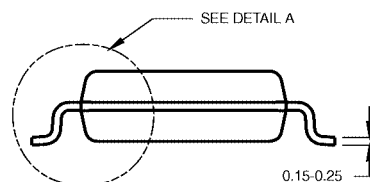




### LAND PATTERN RECOMMENDATION



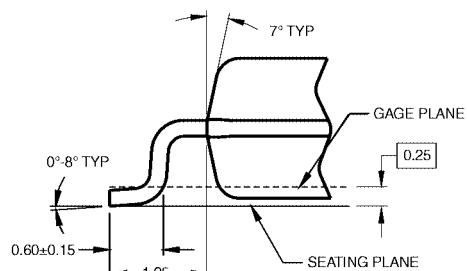
DIMENSIONS ARE IN MILLIMETERS



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.

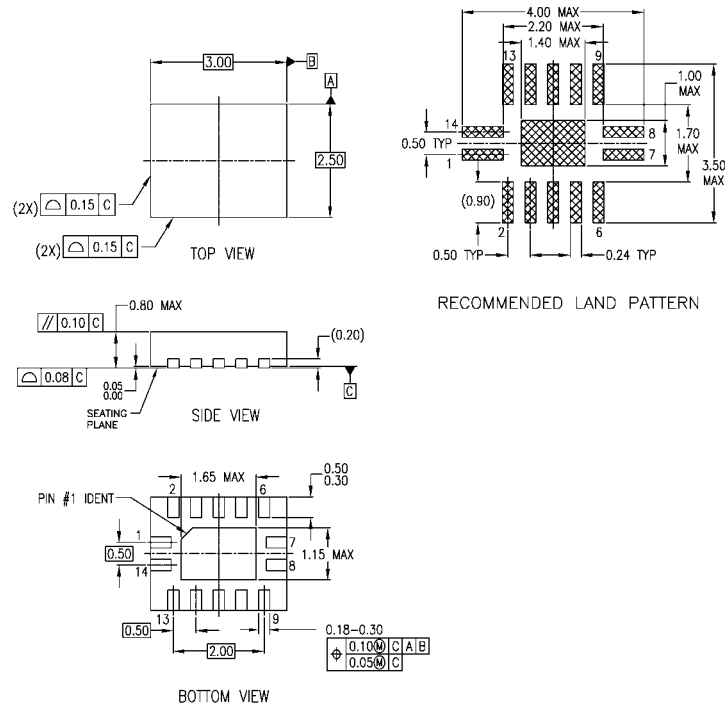
M14DRevB1



DETAIL A

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

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



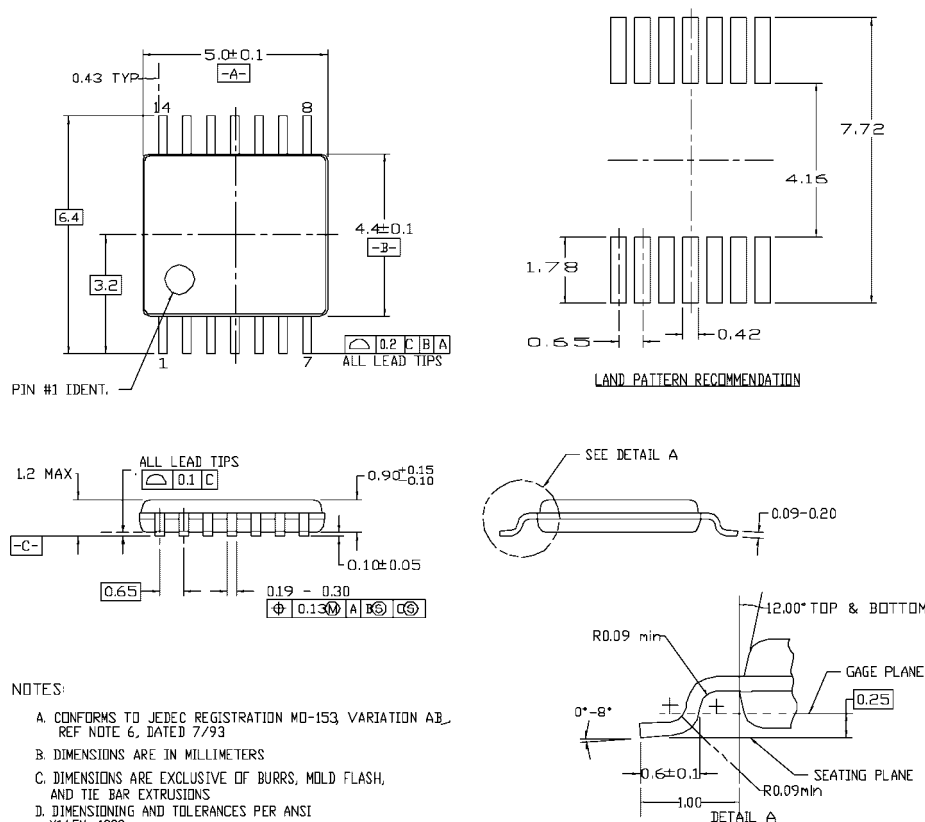
## NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-241, VARIATION AA
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

MLP014ArevA

**Pb-Free 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm  
Package Number MLP014A**

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



MTC14revD

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

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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