

# MC74AC14, MC74ACT14

## Hex Inverter Schmitt Trigger

The MC74AC14/74ACT14 contains six logic inverters which accept standard CMOS Input signals (TTL levels for MC74ACT14) and provide standard CMOS output levels. 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 MC74AC14/74ACT14 has hysteresis between the positive-going and negative-going input thresholds (typically 1.0 V) which is determined internally by transistor ratios and is essentially insensitive to temperature and supply voltage variations.

### Features

- Schmitt Trigger Inputs
- Outputs Source/Sink 24 mA
- MC74ACT14 Has TTL Compatible Inputs
- Pb-Free Packages are Available

### MAXIMUM RATINGS

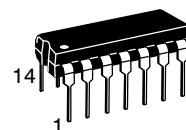
| Rating                                    | Symbol    | Value                  | Unit |
|-------------------------------------------|-----------|------------------------|------|
| DC Supply Voltage (Referenced to GND)     | $V_{CC}$  | -0.5 to +7.0           | V    |
| DC Input Voltage (Referenced to GND)      | $V_{in}$  | -0.5 to $V_{CC} + 0.5$ | V    |
| DC Output Voltage (Referenced to GND)     | $V_{out}$ | -0.5 to $V_{CC} + 0.5$ | V    |
| DC Input Current, per Pin                 | $I_{in}$  | $\pm 20$               | mA   |
| DC Output Sink/Source Current, per Pin    | $I_{out}$ | $\pm 50$               | mA   |
| DC $V_{CC}$ or GND Current per Output Pin | $I_{CC}$  | $\pm 50$               | °C   |
| Storage Temperature                       | $T_{stg}$ | -65 to +150            | mJ   |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

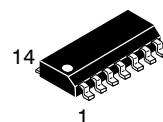


ON Semiconductor®

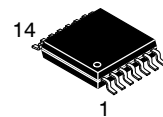
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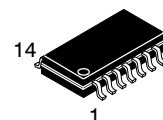
PDIP-14  
SUFFIX N  
CASE 646



SOIC-14  
SUFFIX D  
CASE 751A



TSSOP-14  
SUFFIX DT  
CASE 948G



SOEIAJ-14  
SUFFIX M  
CASE 965

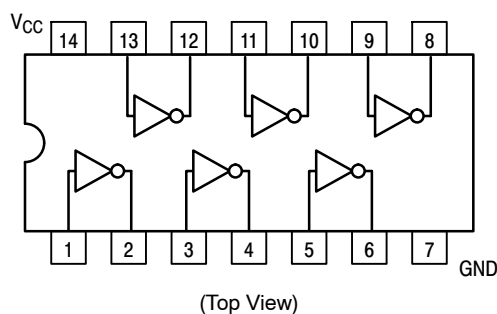


Figure 1. Pinout: 14-Lead Packages Conductors

### FUNCTION TABLE

| Input | Output |
|-------|--------|
| A     | O      |
| L     | H      |
| H     | L      |

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

### DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 4 of this data sheet.

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## RECOMMENDED OPERATING CONDITIONS

| Symbol                             | Parameter                                                               | Min                     | Typ | Max             | Unit |
|------------------------------------|-------------------------------------------------------------------------|-------------------------|-----|-----------------|------|
| V <sub>CC</sub>                    | Supply Voltage                                                          | 'AC                     | 2.0 | 5.0             | V    |
|                                    |                                                                         | 'ACT                    | 4.5 | 5.0             |      |
| V <sub>in</sub> , V <sub>out</sub> | DC Input Voltage, Output Voltage (Ref. to GND)                          | 0                       | –   | V <sub>CC</sub> | V    |
| t <sub>r</sub> , t <sub>f</sub>    | Input Rise and Fall Time (Note 1)<br>'AC Devices except Schmitt Inputs  | V <sub>CC</sub> @ 3.0 V | –   | 150             | ns/V |
|                                    |                                                                         | V <sub>CC</sub> @ 4.5 V | –   | 40              |      |
|                                    |                                                                         | V <sub>CC</sub> @ 5.5 V | –   | 25              |      |
| t <sub>r</sub> , t <sub>f</sub>    | Input Rise and Fall Time (Note 2)<br>'ACT Devices except Schmitt Inputs | V <sub>CC</sub> @ 4.5 V | –   | 10              | ns/V |
|                                    |                                                                         | V <sub>CC</sub> @ 5.5 V | –   | 8.0             |      |
| T <sub>J</sub>                     | Junction Temperature (PDIP)                                             | –                       | –   | 140             | °C   |
| T <sub>A</sub>                     | Operating Ambient Temperature Range                                     | –40                     | 25  | 85              | °C   |
| I <sub>OH</sub>                    | Output Current – High                                                   | –                       | –   | –24             | mA   |
| I <sub>OL</sub>                    | Output Current – Low                                                    | –                       | –   | 24              | mA   |

1. V<sub>in</sub> from 30% to 70% V<sub>CC</sub>; see individual Data Sheets for devices that differ from the typical input rise and fall times.
2. V<sub>in</sub> from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

## DC CHARACTERISTICS

| Symbol           | Parameter                         | V <sub>CC</sub><br>(V) | 74AC                   |                   | 74AC                            |  | Unit | Conditions                                                                                          |
|------------------|-----------------------------------|------------------------|------------------------|-------------------|---------------------------------|--|------|-----------------------------------------------------------------------------------------------------|
|                  |                                   |                        | T <sub>A</sub> = +25°C |                   | T <sub>A</sub> = –40°C to +85°C |  |      |                                                                                                     |
|                  |                                   |                        | Typ                    | Guaranteed Limits |                                 |  |      |                                                                                                     |
| V <sub>OH</sub>  | Minimum High Level Output Voltage | 3.0                    | 2.99                   | 2.9               | 2.9                             |  | V    | I <sub>OUT</sub> = –50 μA                                                                           |
|                  |                                   | 4.5                    | 4.49                   | 4.4               | 4.4                             |  |      |                                                                                                     |
|                  |                                   | 5.5                    | 5.49                   | 5.4               | 5.4                             |  |      |                                                                                                     |
|                  |                                   | 3.0                    | –                      | 2.56              | 2.46                            |  | V    | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>–12 mA<br>I <sub>OH</sub> –24 mA<br>–24 mA |
|                  |                                   | 4.5                    | –                      | 3.86              | 3.76                            |  |      |                                                                                                     |
|                  |                                   | 5.5                    | –                      | 4.86              | 4.76                            |  |      |                                                                                                     |
| V <sub>OL</sub>  | Maximum Low Level Output Voltage  | 3.0                    | 0.002                  | 0.1               | 0.1                             |  | V    | I <sub>OUT</sub> = 50 μA                                                                            |
|                  |                                   | 4.5                    | 0.001                  | 0.1               | 0.1                             |  |      |                                                                                                     |
|                  |                                   | 5.5                    | 0.001                  | 0.1               | 0.1                             |  |      |                                                                                                     |
|                  |                                   | 3.0                    | –                      | 0.36              | 0.44                            |  | V    | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>12 mA<br>I <sub>OL</sub> 24 mA<br>24 mA    |
|                  |                                   | 4.5                    | –                      | 0.36              | 0.44                            |  |      |                                                                                                     |
|                  |                                   | 5.5                    | –                      | 0.36              | 0.44                            |  |      |                                                                                                     |
| I <sub>IN</sub>  | Maximum Input Leakage Current     | 5.5                    | –                      | ±0.1              | ±1.0                            |  | μA   | V <sub>I</sub> = V <sub>CC</sub> , GND                                                              |
| I <sub>OLD</sub> | †Minimum Dynamic Output Current   | 5.5                    | –                      | –                 | 75                              |  | mA   | V <sub>OLD</sub> = 1.65 V Max                                                                       |
| I <sub>OHD</sub> |                                   | 5.5                    | –                      | –                 | –75                             |  | mA   | V <sub>OHD</sub> = 3.85 V Min                                                                       |
| I <sub>CC</sub>  | Maximum Quiescent Supply Current  | 5.5                    | –                      | 4.0               | 40                              |  | μA   | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                            |

\*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

NOTE: I<sub>IN</sub> and I<sub>CC</sub> @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V<sub>CC</sub>.

## AC CHARACTERISTICS (For Figures and Waveforms – See Section 3 of the ON Semiconductor FACT Data Book, DL138/D)

| Symbol           | Parameter         | V <sub>CC</sub> *<br>(V) | 74AC                                          |     |      | 74AC                                                      |      | Unit | Figure<br>No. |
|------------------|-------------------|--------------------------|-----------------------------------------------|-----|------|-----------------------------------------------------------|------|------|---------------|
|                  |                   |                          | T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF |     |      | T <sub>A</sub> = −40°C to<br>+85°C C <sub>L</sub> = 50 pF |      |      |               |
|                  |                   |                          | Min                                           | Typ | Max  | Min                                                       | Max  |      |               |
| t <sub>PLH</sub> | Propagation Delay | 3.3                      | 1.5                                           | 9.5 | 13.5 | 1.5                                                       | 15.0 | ns   | 3–5           |
|                  |                   | 5.0                      | 1.5                                           | 7.0 | 10.0 | 1.5                                                       | 11.0 |      |               |
| t <sub>PHL</sub> | Propagation Delay | 3.3                      | 1.5                                           | 7.5 | 11.5 | 1.5                                                       | 13.0 | ns   | 3–5           |
|                  |                   | 5.0                      | 1.5                                           | 6.0 | 8.5  | 1.5                                                       | 9.5  |      |               |

\*Voltage Range 3.3 V is 3.3 V ±0.3 V. Voltage Range 5.0 V is 5.0 V ±0.5 V.

# MC74AC14, MC74ACT14

## INPUT CHARACTERISTICS (unless otherwise specified)

| Symbol              | Parameter                  | V <sub>CC</sub><br>(V) | 74AC              | 74ACT           |   | Test Conditions             |
|---------------------|----------------------------|------------------------|-------------------|-----------------|---|-----------------------------|
| V <sub>t+</sub>     | Maximum Positive Threshold | 3.0<br>4.5<br>5.5      | 2.2<br>3.2<br>3.9 | –<br>2.0<br>2.0 | V | T <sub>A</sub> = Worst Case |
| V <sub>t–</sub>     | Minimum Negative Threshold | 3.0<br>4.5<br>5.5      | 0.5<br>0.9<br>1.1 | –<br>0.8<br>0.8 | V | T <sub>A</sub> = Worst Case |
| V <sub>h(max)</sub> | Maximum Hysteresis         | 3.0<br>4.5<br>5.5      | 1.2<br>1.4<br>1.6 | –<br>1.2<br>1.2 | V | T <sub>A</sub> = Worst Case |
| V <sub>h(min)</sub> | Minimum Hysteresis         | 3.0<br>4.5<br>5.5      | 0.3<br>0.4<br>0.5 | –<br>0.4<br>0.4 | V | T <sub>A</sub> = Worst Case |

## DC CHARACTERISTICS

| Symbol            | Parameter                              | V <sub>CC</sub><br>(V) | 74ACT                  |                   | 74ACT                           |    | Unit                                                                                      | Conditions |
|-------------------|----------------------------------------|------------------------|------------------------|-------------------|---------------------------------|----|-------------------------------------------------------------------------------------------|------------|
|                   |                                        |                        | T <sub>A</sub> = +25°C |                   | T <sub>A</sub> = –40°C to +85°C |    |                                                                                           |            |
|                   |                                        |                        | Typ                    | Guaranteed Limits |                                 |    |                                                                                           |            |
| V <sub>OH</sub>   | Minimum High Level Output Voltage      | 4.5                    | 4.49                   | 4.4               | 4.4                             | V  | I <sub>OUT</sub> = –50 μA                                                                 |            |
|                   |                                        | 5.5                    | 5.49                   | 5.4               | 5.4                             |    |                                                                                           |            |
|                   |                                        | 4.5                    | –                      | 3.86              | 3.76                            | V  | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OH</sub> –24 mA<br>–24 mA |            |
|                   |                                        | 5.5                    | –                      | 4.86              | 4.76                            |    |                                                                                           |            |
| V <sub>OL</sub>   | Maximum Low Level Output Voltage       | 4.5                    | 0.001                  | 0.1               | 0.1                             | V  | I <sub>OUT</sub> = 50 μA                                                                  |            |
|                   |                                        | 5.5                    | 0.001                  | 0.1               | 0.1                             |    |                                                                                           |            |
|                   |                                        | 4.5                    | –                      | 0.36              | 0.44                            | V  | *V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>24 mA<br>I <sub>OL</sub> 24 mA   |            |
|                   |                                        | 5.5                    | –                      | 0.36              | 0.44                            |    |                                                                                           |            |
| I <sub>IN</sub>   | Maximum Input Leakage Current          | 5.5                    | –                      | ±0.1              | ±1.0                            | μA | V <sub>I</sub> = V <sub>CC</sub> , GND                                                    |            |
| ΔI <sub>CCT</sub> | Additional Max. I <sub>CC</sub> /Input | 5.5                    | 0.6                    | –                 | 1.5                             | mA | V <sub>I</sub> = V <sub>CC</sub> – 2.1 V                                                  |            |
| I <sub>OLD</sub>  | †Minimum Dynamic Output Current        | 5.5                    | –                      | –                 | 75                              | mA | V <sub>OLD</sub> = 1.65 V Max                                                             |            |
| I <sub>OHD</sub>  |                                        | 5.5                    | –                      | –                 | –75                             | mA | V <sub>OHD</sub> = 3.85 V Min                                                             |            |
| I <sub>CC</sub>   | Maximum Quiescent Supply Current       | 5.5                    | –                      | 4.0               | 40                              | μA | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                  |            |

\*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

## AC CHARACTERISTICS (For Figures and Waveforms – See Section 3 of the ON Semiconductor FACT Data Book, DL138/D)

| Symbol           | Parameter         | V <sub>CC</sub> *<br>(V) | 74ACT                                         |     |      | 74ACT                                                  |      | Unit | Figure No. |
|------------------|-------------------|--------------------------|-----------------------------------------------|-----|------|--------------------------------------------------------|------|------|------------|
|                  |                   |                          | T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF |     |      | T <sub>A</sub> = –40°C to +85°C C <sub>L</sub> = 50 pF |      |      |            |
|                  |                   |                          | Min                                           | Typ | Max  | Min                                                    | Max  |      |            |
| t <sub>PLH</sub> | Propagation Delay | 5.0                      | 1.5                                           | –   | 11.5 | 1.0                                                    | 12.5 | ns   | 3–5        |
| t <sub>PHL</sub> | Propagation Delay | 5.0                      | 1.5                                           | –   | 10.0 | 1.0                                                    | 11.0 | ns   | 3–5        |

\*Voltage Range 5.0 V is 5.0 V ±0.5 V.

## CAPACITANCE

| Symbol          | Parameter                     | Value Typ | Unit | Test Conditions         |
|-----------------|-------------------------------|-----------|------|-------------------------|
| C <sub>IN</sub> | Input Capacitance             | 4.5       | pF   | V <sub>CC</sub> = 5.0 V |
| C <sub>PD</sub> | Power Dissipation Capacitance | 25        | pF   | V <sub>CC</sub> = 5.0 V |

# MC74AC14, MC74ACT14

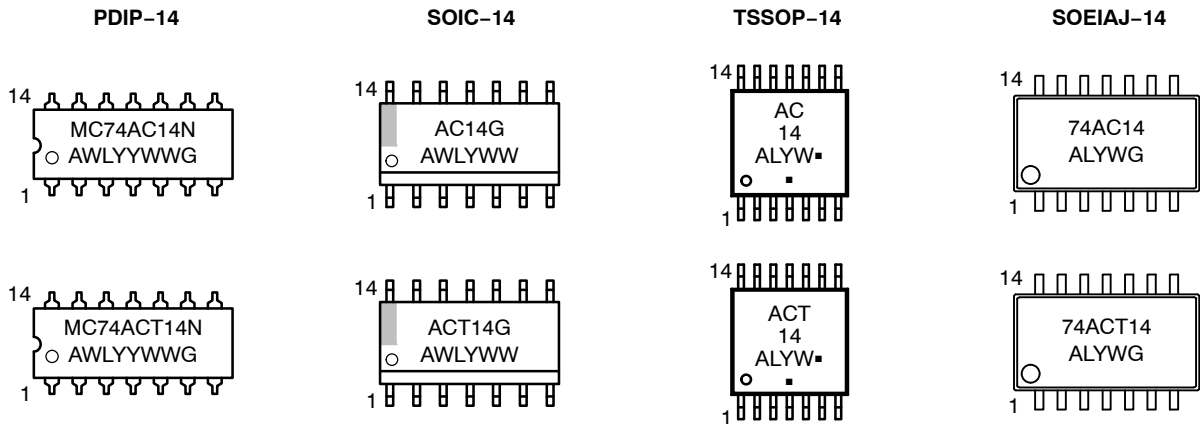
## ORDERING INFORMATION

| Device         | Package                | Shipping†          |
|----------------|------------------------|--------------------|
| MC74AC14NG     | PDIP-14<br>(Pb-Free)   | 25 Units / Rail    |
| MC74ACT14NG    | PDIP-14<br>(Pb-Free)   |                    |
| MC74AC14D      | SOIC-14                | 55 Units / Rail    |
| MC74AC14DG     | SOIC-14<br>(Pb-Free)   |                    |
| MC74AC14DR2G   | SOIC-14<br>(Pb-Free)   | 2500 / Tape & Reel |
| MC74ACT14DG    | SOIC-14<br>(Pb-Free)   | 55 Units / Rail    |
| MC74ACT14DR2   | SOIC-14                | 2500 / Tape & Reel |
| MC74ACT14DR2G  | SOIC-14<br>(Pb-Free)   |                    |
| MC74AC14DTR2   | TSSOP-14*              |                    |
| MC74AC14DTR2G  | TSSOP-14*              |                    |
| MC74ACT14DTR2  | TSSOP-14*              |                    |
| MC74ACT14DTR2G | TSSOP-14*              |                    |
| MC74AC14MEL    | SOEIAJ-14              | 2000 / Tape & Reel |
| MC74AC14MELG   | SOEIAJ-14<br>(Pb-Free) |                    |
| MC74ACT14MELG  | SOEIAJ-14<br>(Pb-Free) |                    |

†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.

## MARKING DIAGRAMS



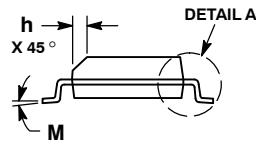
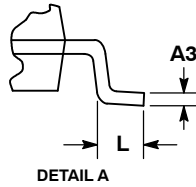
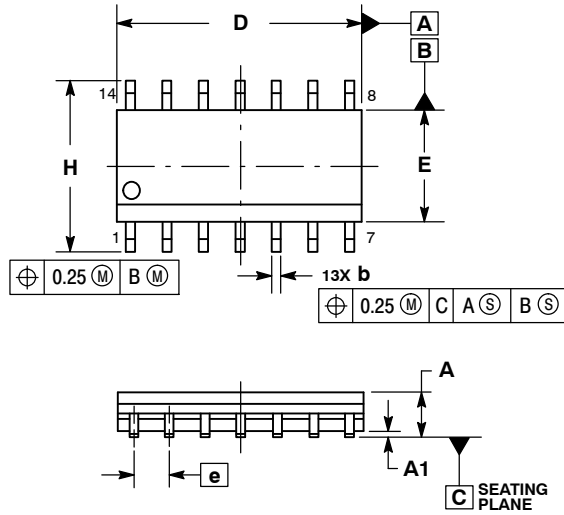
A = Assembly Location  
 WL, L = Wafer Lot  
 YY, Y = Year  
 WW, W = Work Week  
 G or ■ = Pb-Free Package  
 (Note: Microdot may be in either location)



# MC74AC14, MC74ACT14

## PACKAGE DIMENSIONS

**SOIC-14 NB**  
CASE 751A-03  
ISSUE K

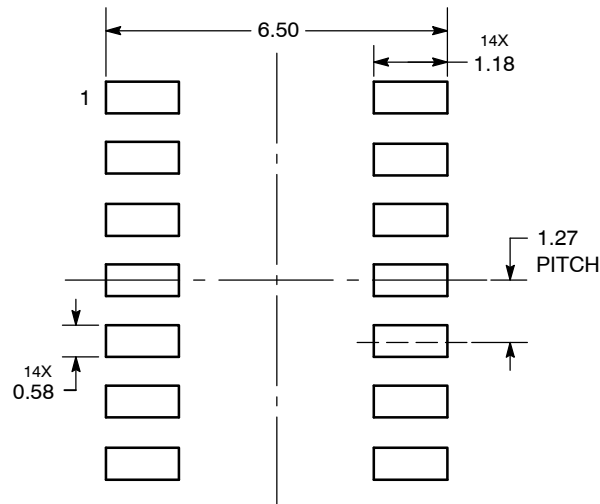


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION  $b$  DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

|     | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
| DIM | MIN         | MAX  | MIN       | MAX   |
| A   | 1.35        | 1.75 | 0.054     | 0.068 |
| A1  | 0.10        | 0.25 | 0.004     | 0.010 |
| A3  | 0.19        | 0.25 | 0.008     | 0.010 |
| b   | 0.35        | 0.49 | 0.014     | 0.019 |
| D   | 8.55        | 8.75 | 0.337     | 0.344 |
| E   | 3.80        | 4.00 | 0.150     | 0.157 |
| e   | 1.27 BSC    |      | 0.050 BSC |       |
| H   | 5.80        | 6.20 | 0.228     | 0.244 |
| h   | 0.25        | 0.50 | 0.010     | 0.019 |
| L   | 0.40        | 1.25 | 0.016     | 0.049 |
| M   | 0°          | 7°   | 0°        | 7°    |

### SOLDERING FOOTPRINT\*



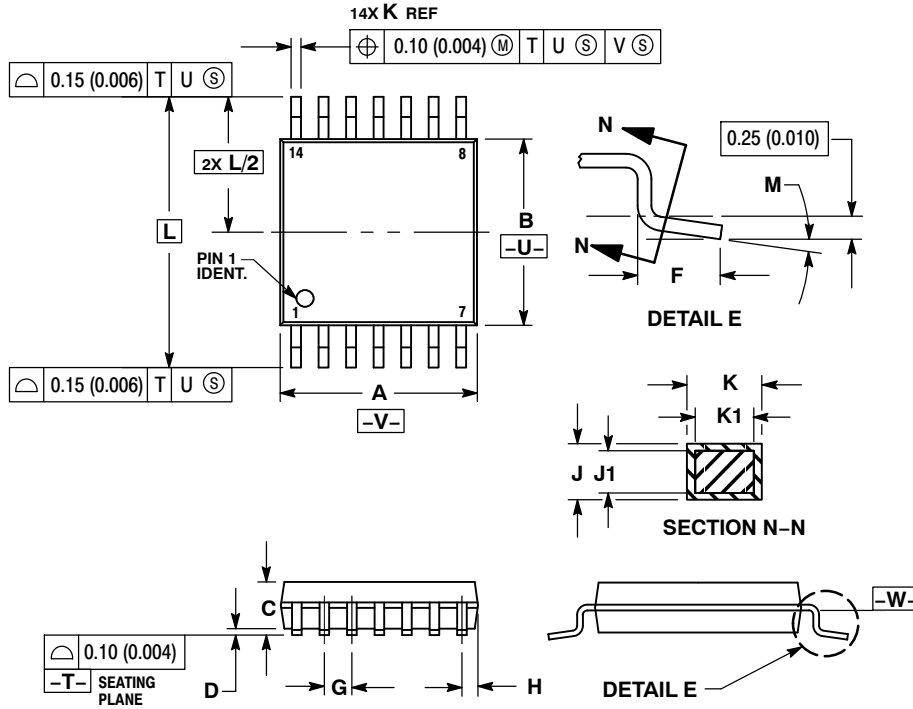
DIMENSIONS: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MC74AC14, MC74ACT14

## PACKAGE DIMENSIONS

TSSOP-14  
CASE 948G-01  
ISSUE B

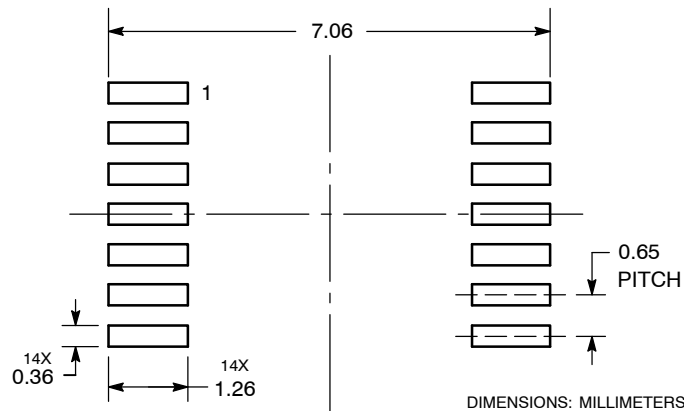


### NOTES:

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\*

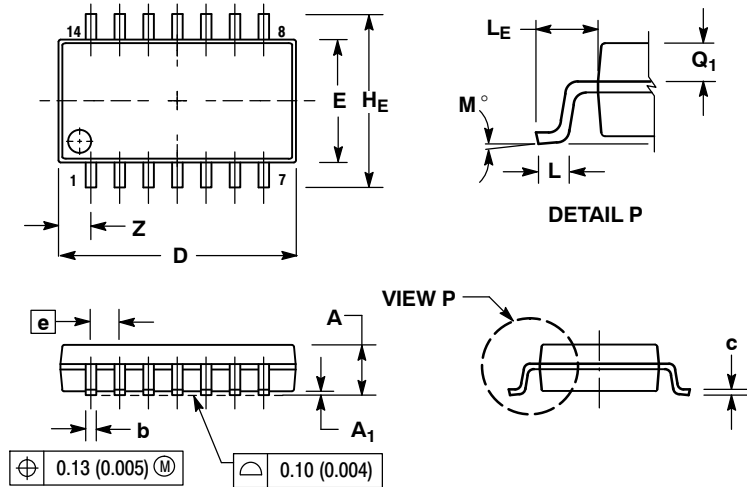


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MC74AC14, MC74ACT14

## PACKAGE DIMENSIONS

SOEIAJ-14  
M SUFFIX  
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 |
| L <sub>E</sub> | 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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