

# MC74HC132A

## Quad 2-Input NAND Gate with Schmitt-Trigger Inputs

### High-Performance Silicon-Gate CMOS

The MC74HC132A is identical in pinout to the LS132. The device inputs are compatible with standard CMOS outputs; with pull-up resistors, they are compatible with LSTTL outputs.

The HC132A can be used to enhance noise immunity or to square up slowly changing waveforms.

#### Features

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1.0  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements as Defined by JEDEC Standard No. 7A
- Chip Complexity: 72 FETs or 18 Equivalent Gates
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

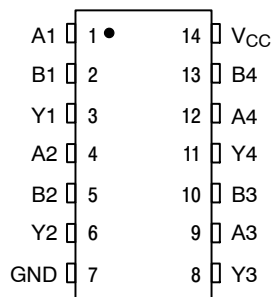


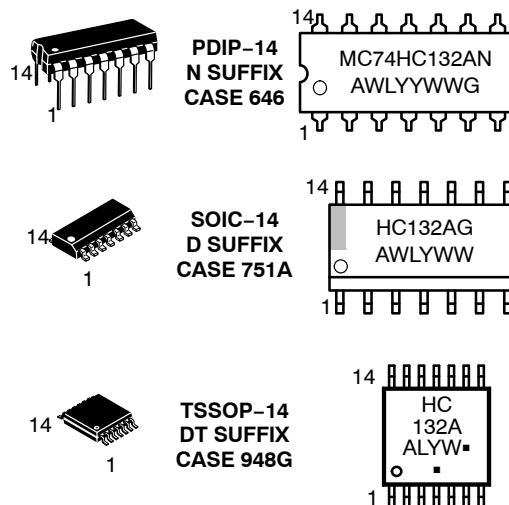
Figure 1. Pin Assignment



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#### MARKING DIAGRAMS



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

(Note: Microdot may be in either location)

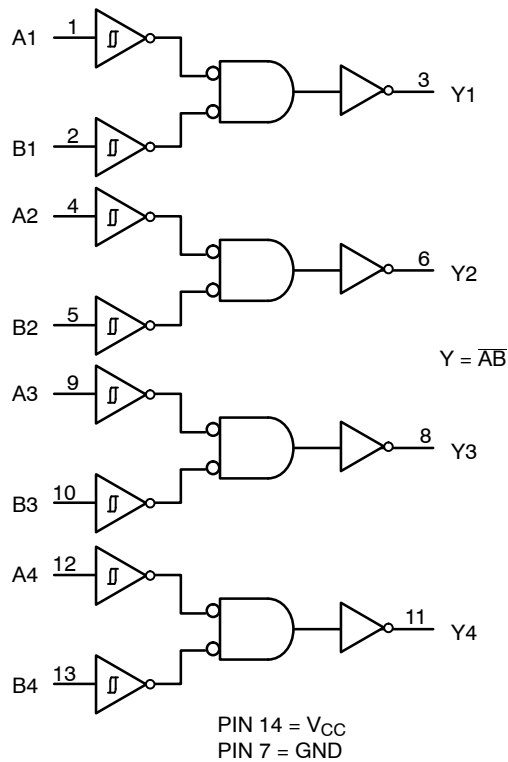
#### FUNCTION TABLE

| Inputs |   | Output |
|--------|---|--------|
| A      | B | Y      |
| L      | L | H      |
| L      | H | H      |
| H      | L | H      |
| H      | H | L      |

#### ORDERING INFORMATION

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

## MC74HC132A



**Figure 2. Logic Diagram**

### ORDERING INFORMATION

| Device            | Package               | Shipping†            |
|-------------------|-----------------------|----------------------|
| MC74HC132ANG      | PDIP-14<br>(Pb-Free)  | 25 / Tape & Ammo Box |
| MC74HC132ADG      | SOIC-14<br>(Pb-Free)  | 55 Units / Rail      |
| MC74HC132ADR2G    | SOIC-14<br>(Pb-Free)  | 2500 / Tape & Reel   |
| MC74HC132ADTG     | TSSOP-14<br>(Pb-Free) | 96 Units / Rail      |
| MC74HC132ADTR2G   | TSSOP-14<br>(Pb-Free) | 2500 / Tape & Reel   |
| NLV74HC132ADG*    | SOIC-14<br>(Pb-Free)  | 55 Units / Rail      |
| NLV74HC132ADR2G*  | SOIC-14<br>(Pb-Free)  | 2500 / Tape & Reel   |
| NLV74HC132ADTG*   | TSSOP-14<br>(Pb-Free) | 96 Units / Rail      |
| NLV74HC132ADTR2G* | TSSOP-14<br>(Pb-Free) | 2500 / Tape & Reel   |
| NLV74HC132ANG*    | PDIP-14<br>(Pb-Free)  | 25 Units / Rail      |

†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.

\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable

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## MAXIMUM RATINGS

| Symbol         | Parameter   | Value                                     | Unit |
|----------------|---|---|------|
| $V_{CC}$       | Positive DC Supply Voltage  | - 0.5 to + 7.0                            | V    |
| $V_{IN}$       | Digital Input Voltage   | - 0.5 to + 7.0                            | V    |
| $V_{OUT}$      | DC Output Voltage<br>Output in 3-State<br>High or Low State   | - 0.5 to + 7.0<br>- 0.5 to $V_{CC}$ + 0.5 | V    |
| $I_{IK}$       | Input Diode Current   | - 20                                      | mA   |
| $I_{OK}$       | Output Diode Current  | ± 20                                      | mA   |
| $I_{OUT}$      | DC Output Current, per Pin  | ± 25                                      | mA   |
| $I_{CC}$       | DC Supply Current, $V_{CC}$ and GND Pins  | ± 75                                      | mA   |
| $I_{GND}$      | DC Ground Current per Ground Pin  | ± 75                                      | mA   |
| $T_{STG}$      | Storage Temperature Range   | - 65 to + 150                             | °C   |
| $T_L$          | Lead Temperature, 1 mm from Case for 10 Seconds   | 260                                       | °C   |
| $T_J$          | Junction Temperature Under Bias   | + 150                                     | °C   |
| $\theta_{JA}$  | Thermal Resistance<br>14-PDIP<br>14-SOIC<br>14-TSSOP  | 78<br>125<br>170                          | °C/W |
| $P_D$          | Power Dissipation in Still Air at 85°C<br>PDIP<br>SOIC<br>TSSOP   | 750<br>500<br>450                         | mW   |
| MSL            | Moisture Sensitivity  | Level 1                                   |      |
| $F_R$          | Flammability Rating<br>Oxygen Index: 30% - 35%  | UL 94 V0 @ 0.125 in                       |      |
| $V_{ESD}$      | ESD Withstand Voltage<br>Human Body Model (Note 1)<br>Machine Model (Note 2)<br>Charged Device Model (Note 3) | > 2000<br>> 100<br>> 500                  | V    |
| $I_{Latch-Up}$ | Latch-Up Performance<br>Above $V_{CC}$ and Below GND at 85°C (Note 4)   | ± 300                                     | mA   |

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.

1. Tested to EIA/JESD22-A114-A.
2. Tested to EIA/JESD22-A115-A.
3. Tested to JESD22-C101-A.
4. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol            | Parameter  | Min  | Max                  | Unit |
|-------------------|--|------|----------------------|------|
| $V_{CC}$          | DC Supply Voltage (Referenced to GND)                | 2.0  | 6.0                  | V    |
| $V_{IN}, V_{OUT}$ | DC Input Voltage, Output Voltage (Referenced to GND) | 0    | $V_{CC}$             | V    |
| $T_A$             | Operating Temperature, All Package Types             | - 55 | + 125                | °C   |
| $t_r, t_f$        | Input Rise and Fall Time (Figure 3)                  | -    | No Limit<br>(Note 5) | ns   |

5. When  $V_{IN} \sim 0.5 V_{CC}$ ,  $I_{CC} \gg$  quiescent current.
6. Unused inputs may not be left open. All inputs must be tied to a high-logic voltage level or a low-logic input voltage level.

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## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

| Symbol                      | Parameter   | Test Conditions   | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|-----------------------------|---|---|----------------------|------------------|--------|---------|------|
|                             |   |   |                      | -55°C to 25°C    | ≤ 85°C | ≤ 125°C |      |
| V <sub>T+</sub> max         | Maximum Positive-Going Input Threshold Voltage (Figure 5) | V <sub>OUT</sub> = 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA   | 2.0                  | 1.5              | 1.5    | 1.5     | V    |
|                             |   |   | 4.5                  | 3.15             | 3.15   | 3.15    |      |
|                             |   |   | 6.0                  | 4.2              | 4.2    | 4.2     |      |
| V <sub>T+</sub> min         | Minimum Positive-Going Input Threshold Voltage (Figure 5) | V <sub>OUT</sub> = 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA   | 2.0                  | 1.0              | 0.95   | 0.95    | V    |
|                             |   |   | 4.5                  | 2.3              | 2.25   | 2.25    |      |
|                             |   |   | 6.0                  | 3.0              | 2.95   | 2.95    |      |
| V <sub>T-</sub> max         | Maximum Negative-Going Input Threshold Voltage (Figure 5) | V <sub>OUT</sub> = V <sub>CC</sub> - 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA   | 2.0                  | 0.9              | 0.95   | 0.95    | V    |
|                             |   |   | 4.5                  | 2.0              | 2.05   | 2.05    |      |
|                             |   |   | 6.0                  | 2.6              | 2.65   | 2.65    |      |
| V <sub>T-</sub> min         | Minimum Negative-Going Input Threshold Voltage (Figure 5) | V <sub>OUT</sub> = V <sub>CC</sub> - 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA   | 2.0                  | 0.3              | 0.3    | 0.3     | V    |
|                             |   |   | 4.5                  | 0.9              | 0.9    | 0.9     |      |
|                             |   |   | 6.0                  | 1.2              | 1.2    | 1.2     |      |
| V <sub>H</sub> max (Note 7) | Maximum Hysteresis Voltage (Figure 5)                     | V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA  | 2.0                  | 1.2              | 1.2    | 1.2     | V    |
|                             |   |   | 4.5                  | 2.25             | 2.25   | 2.25    |      |
|                             |   |   | 6.0                  | 3.0              | 3.0    | 3.0     |      |
| V <sub>H</sub> min (Note 7) | Minimum Hysteresis Voltage (Figure 5)                     | V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V<br> I <sub>OUT</sub>   ≤ 20 μA  | 2.0                  | 0.2              | 0.2    | 0.2     | V    |
|                             |   |   | 4.5                  | 0.4              | 0.4    | 0.4     |      |
|                             |   |   | 6.0                  | 0.5              | 0.5    | 0.5     |      |
| V <sub>OH</sub>             | Minimum High-Level Output Voltage                         | V <sub>IN</sub> ≤ V <sub>T-</sub> min or V <sub>T+</sub> max<br> I <sub>OUT</sub>   ≤ 20 μA                                   | 2.0                  | 1.9              | 1.9    | 1.9     | V    |
|                             |   |   | 4.5                  | 4.4              | 4.4    | 4.4     |      |
|                             |   | V <sub>IN</sub> ≤ -V <sub>T-</sub> min or V <sub>T+</sub> max<br> I <sub>OUT</sub>   ≤ 4.0 mA<br> I <sub>OUT</sub>   ≤ 5.2 mA | 4.5                  | 3.98             | 3.84   | 3.7     |      |
|                             |   |   | 6.0                  | 5.48             | 5.34   | 5.2     |      |
| V <sub>OL</sub>             | Maximum Low-Level Output Voltage                          | V <sub>IN</sub> ≥ V <sub>T+</sub> max<br> I <sub>OUT</sub>   ≤ 20 μA  | 2.0                  | 0.1              | 0.1    | 0.1     | V    |
|                             |   |   | 4.5                  | 0.1              | 0.1    | 0.1     |      |
|                             |   | V <sub>IN</sub> ≥ V <sub>T+</sub> max<br> I <sub>OUT</sub>   ≤ 4.0 mA<br> I <sub>OUT</sub>   ≤ 5.2 mA                         | 4.5                  | 0.26             | 0.33   | 0.4     |      |
|                             |   |   | 6.0                  | 0.26             | 0.33   | 0.4     |      |
| I <sub>IN</sub>             | Maximum Input Leakage Current                             | V <sub>IN</sub> = V <sub>CC</sub> or GND  | 6.0                  | ± 0.1            | ± 1.0  | ± 1.0   | μA   |
| I <sub>CC</sub>             | Maximum Quiescent Supply Current (per Package)            | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>I <sub>OUT</sub> = 0 μA   | 6.0                  | 1.0              | 10     | 40      | μA   |

7. V<sub>H</sub>min > (V<sub>T+</sub>min) - (V<sub>T-</sub>max); V<sub>H</sub>max = (V<sub>T+</sub>max) + (V<sub>T-</sub>min).

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## AC ELECTRICAL CHARACTERISTICS ( $C_L = 50 \text{ pF}$ , Input $t_r = t_f = 6.0 \text{ ns}$ )

| Symbol                   | Parameter  | $V_{CC}$<br>V   | Guaranteed Limit                          |                         |                          | Unit |
|--------------------------|--|---|---|-------------------------|--------------------------|------|
|                          |  |   | $-55^\circ\text{C}$ to $25^\circ\text{C}$ | $\leq 85^\circ\text{C}$ | $\leq 125^\circ\text{C}$ |      |
| $t_{PLH}$ ,<br>$t_{PHL}$ | Maximum Propagation Delay, Input A or B to Output Y<br>(Figures 3 and 4) | 2.0<br>4.5<br>6.0                                       | 125<br>25<br>21                           | 155<br>31<br>26         | 190<br>38<br>32          | ns   |
| $t_{TLH}$ ,<br>$t_{THL}$ | Maximum Output Transition Time, Any Output<br>(Figures 3 and 4)          | 2.0<br>4.5<br>6.0                                       | 75<br>15<br>13                            | 95<br>19<br>16          | 110<br>22<br>19          | ns   |
| $C_{in}$                 | Maximum Input Capacitance  | —   | 10  | 10                      | 10                       | pF   |
| $C_{PD}$                 | Power Dissipation Capacitance (per Gate) (Note 8)                        | Typical @ $25^\circ\text{C}$ , $V_{CC} = 5.0 \text{ V}$ |   |                         | pF                       |      |
|                          |  | 24  |   |                         |                          |      |

8. Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ .

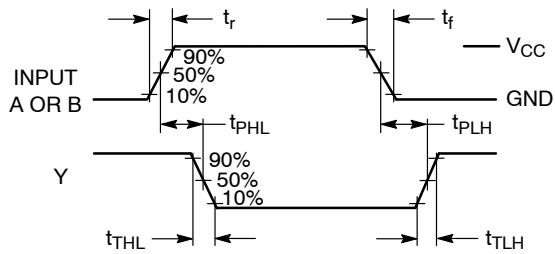
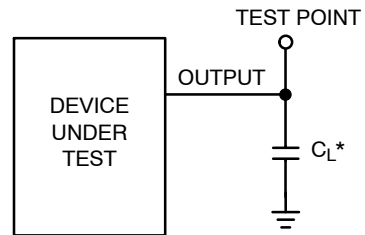


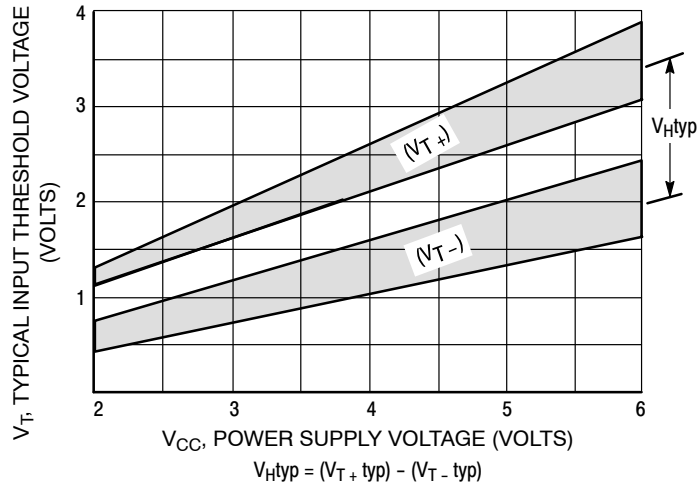
Figure 3. Switching Waveforms



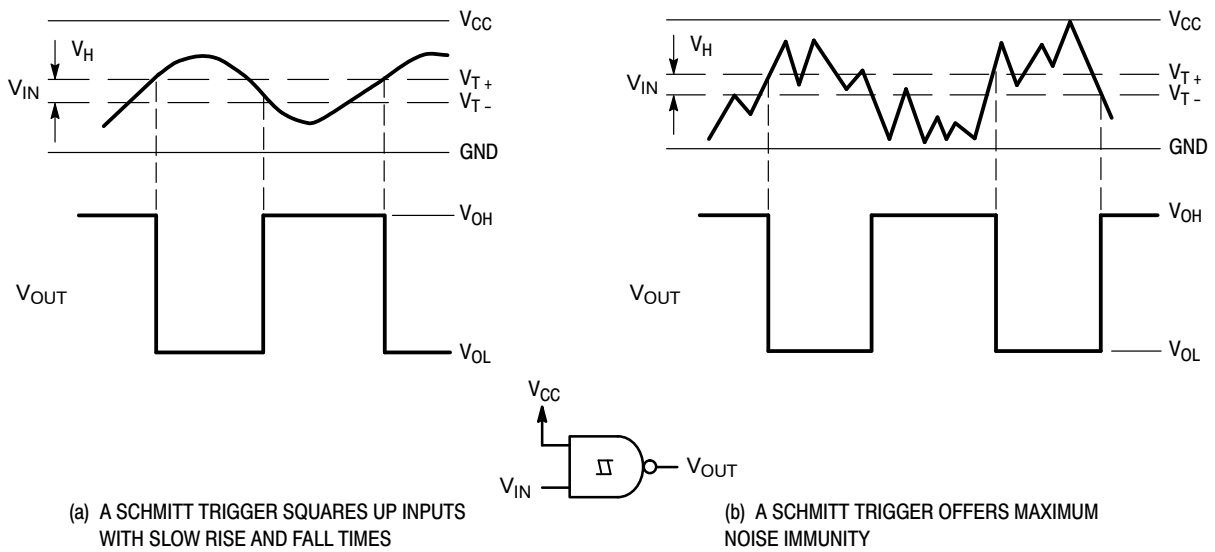
\*Includes all probe and jig capacitance

Figure 4. Test Circuit

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

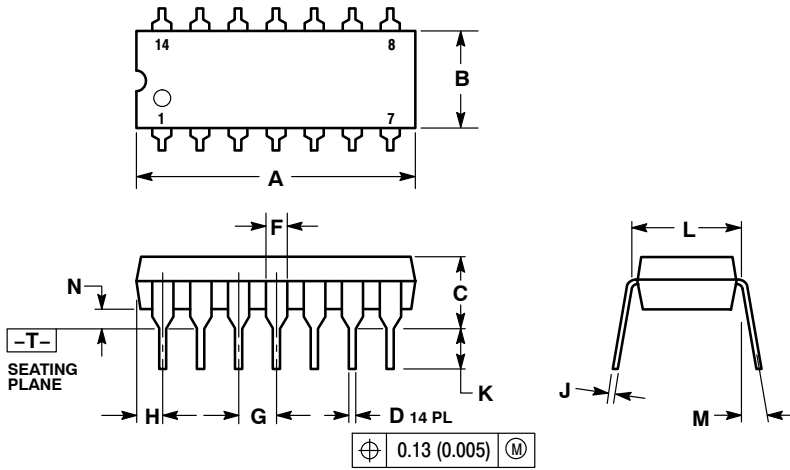


**Figure 6. Typical Schmitt-Trigger Applications**

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## PACKAGE DIMENSIONS

PDIP-14  
N SUFFIX  
CASE 646-06  
ISSUE P



### NOTES:

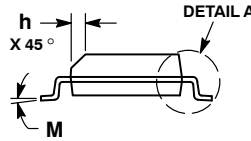
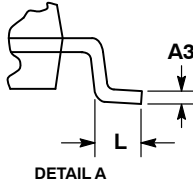
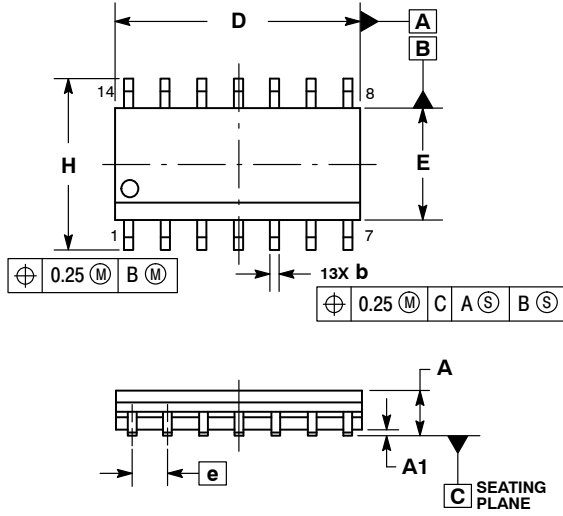
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.715     | 0.770 | 18.16       | 19.56 |
| B   | 0.240     | 0.260 | 6.10        | 6.60  |
| C   | 0.145     | 0.185 | 3.69        | 4.69  |
| D   | 0.015     | 0.021 | 0.38        | 0.53  |
| F   | 0.040     | 0.070 | 1.02        | 1.78  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.052     | 0.095 | 1.32        | 2.41  |
| J   | 0.008     | 0.015 | 0.20        | 0.38  |
| K   | 0.115     | 0.135 | 2.92        | 3.43  |
| L   | 0.290     | 0.310 | 7.37        | 7.87  |
| M   | ---       | 10°   | ---         | 10°   |
| N   | 0.015     | 0.039 | 0.38        | 1.01  |

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## PACKAGE DIMENSIONS

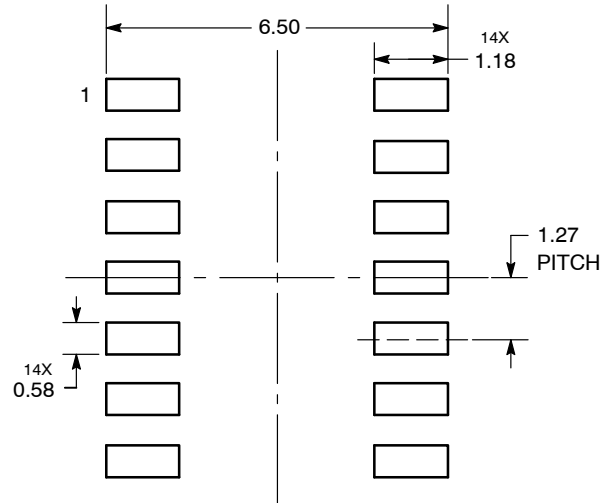
SOIC-14 NB  
CASE 751A-03  
ISSUE K



- 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.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | 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

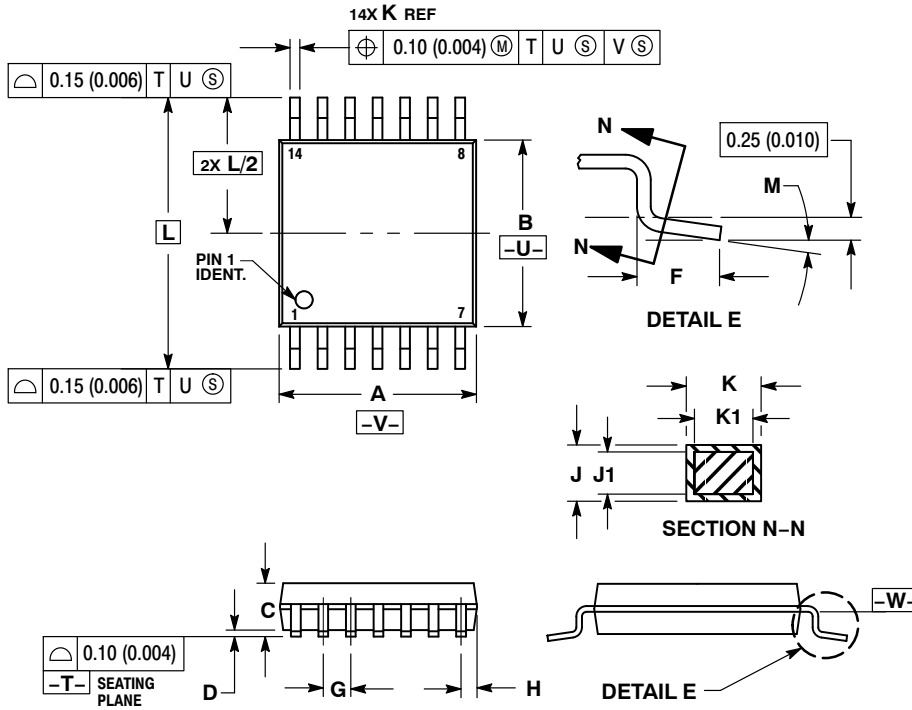
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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## PACKAGE DIMENSIONS

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

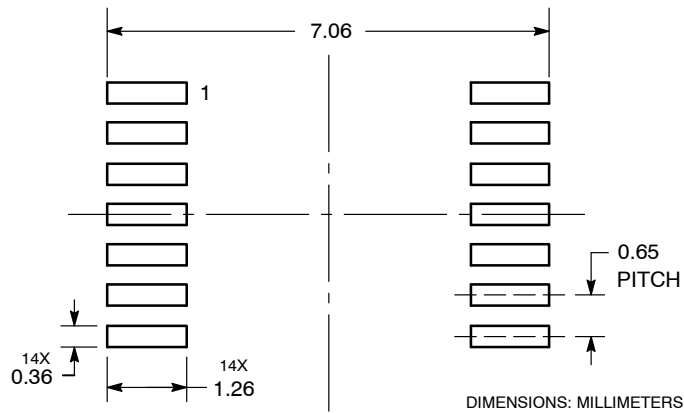


### NOTES:


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\*



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

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