

# MC74LVX14

## Hex Schmitt Inverter

### With 5 V-Tolerant Inputs

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

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

#### Features

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

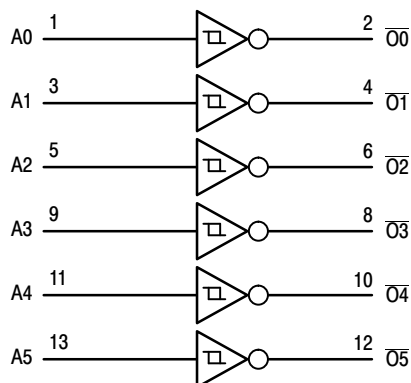


Figure 1. Logic Diagram

#### PIN NAMES

| Pins           | Function                    |
|----------------|-----------------------------|
| $A_n$<br>$O_n$ | Data Inputs<br>Data Outputs |

#### FUNCTION TABLE

| $A_n$ | $O_n$ |
|-------|-------|
| L     | H     |
| H     | L     |



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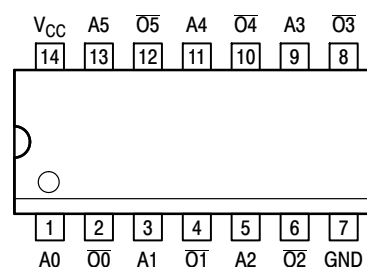


SOIC-14 NB  
D SUFFIX  
CASE 751A



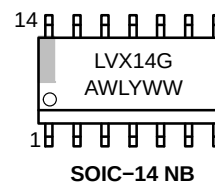
TSSOP-14  
DT SUFFIX  
CASE 948G

#### PIN ASSIGNMENT

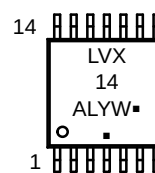


14-Lead (Top View)

#### MARKING DIAGRAMS



SOIC-14 NB



TSSOP-14

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

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

# MC74LVX14

## MAXIMUM RATINGS

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

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

## RECOMMENDED OPERATING CONDITIONS

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

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

## DC ELECTRICAL CHARACTERISTICS

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

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

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

1. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH-to-LOW ( $t_{OSHL}$ ) or LOW-to-HIGH ( $t_{OSLH}$ ); parameter guaranteed by design.

## CAPACITIVE CHARACTERISTICS

| Symbol          | Parameter                              | T <sub>A</sub> = 25°C |     |     | T <sub>A</sub> = -40 to 85°C |     | Unit |
|-----------------|----------------------------------------|-----------------------|-----|-----|------------------------------|-----|------|
|                 |                                        | Min                   | Typ | Max | Min                          | Max |      |
| C <sub>in</sub> | Input Capacitance                      |                       | 4   | 10  |                              | 10  | pF   |
| C <sub>PD</sub> | Power Dissipation Capacitance (Note 2) |                       | 21  |     |                              |     | pF   |

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

NOISE CHARACTERISTICS (Input  $t_r = t_f = 3.0$  ns, C<sub>L</sub> = 50 pF, V<sub>CC</sub> = 3.3 V, Measured in SOIC Package)

| 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      |                       | 0.9  | V    |

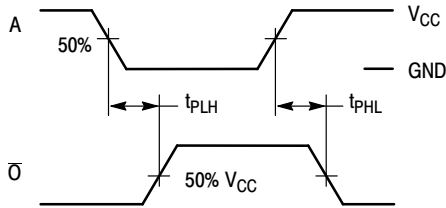
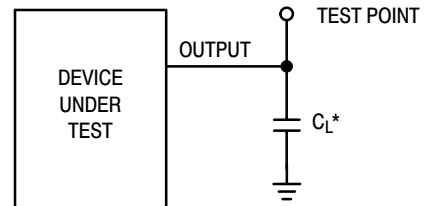


Figure 2. Switching Waveforms



\*Includes all probe and jig capacitance

Figure 3. Test Circuit

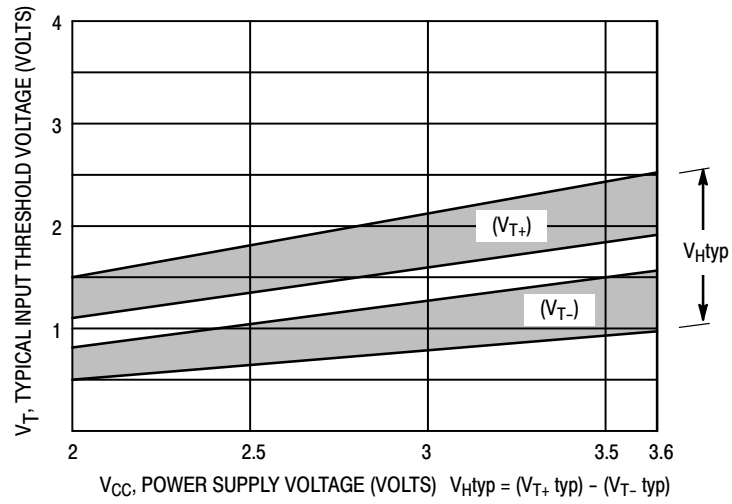
## ORDERING INFORMATION

| Device           | Package              | Shipping <sup>†</sup> |
|------------------|----------------------|-----------------------|
| MC74LVX14DR2G    | SOIC-14 NB (Pb-Free) | 2500 Tape & Reel      |
| MC74LVX14DTR2G   | TSSOP-14 (Pb-Free)   | 2500 Tape & Reel      |
| NLV74LVX14DTR2G* | TSSOP-14 (Pb-Free)   | 2500 Tape & Reel      |

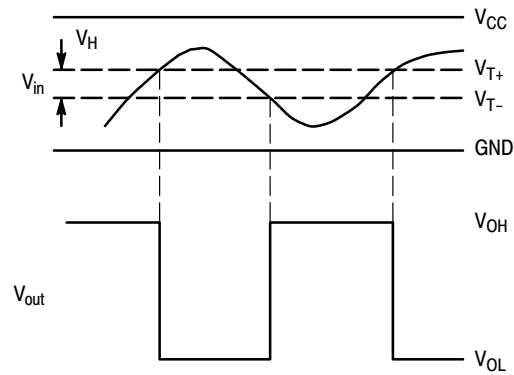
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

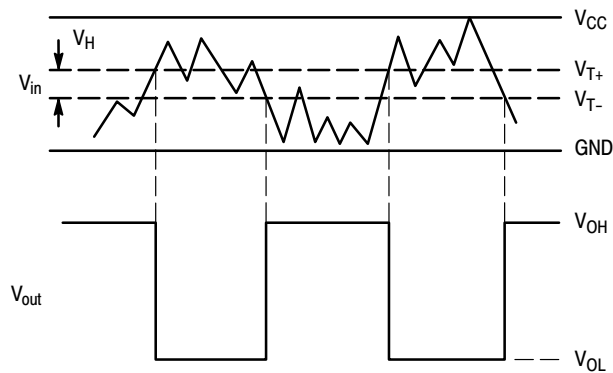
# MC74LVX14



**Figure 4. Typical Input Threshold,  $V_{T+}$ ,  $V_{T-}$  versus Power Supply Voltage**



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



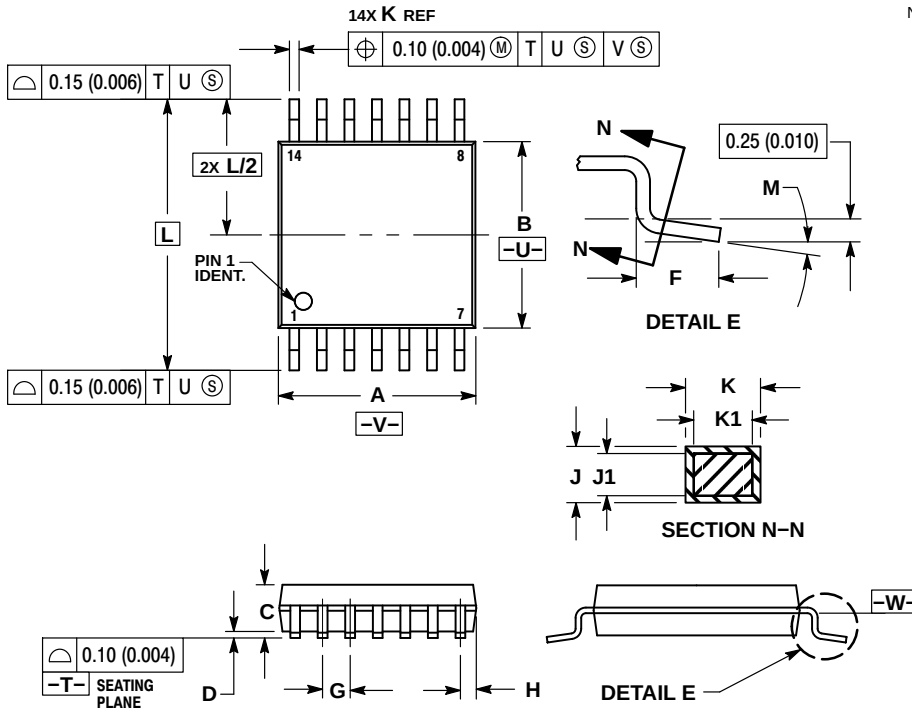
**(b) A Schmitt-Trigger Offers Maximum Noise Immunity**

**Figure 5. Typical Schmitt-Trigger Applications**

# MC74LVX14

## PACKAGE DIMENSIONS

TSSOP-14  
CASE 948G  
ISSUE B

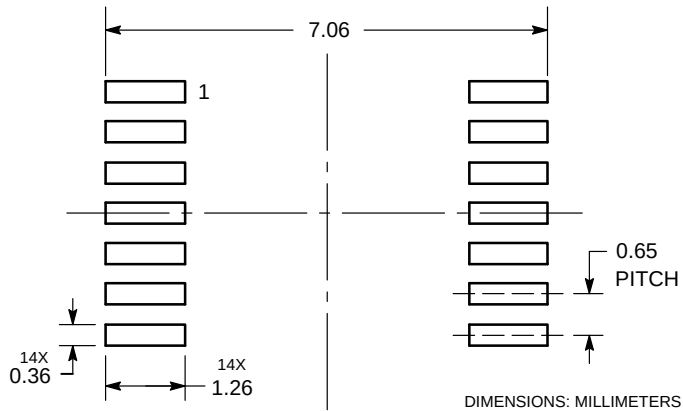


### NOTES:

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\*

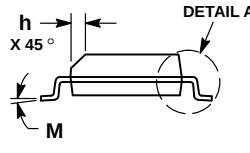
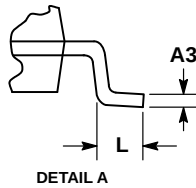
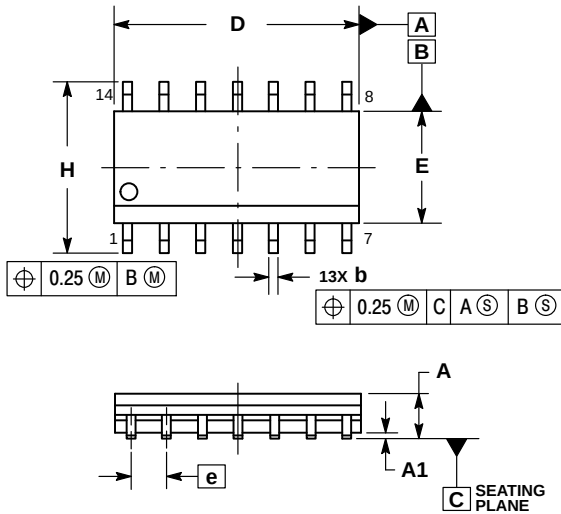


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MC74LVX14

## PACKAGE DIMENSIONS

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

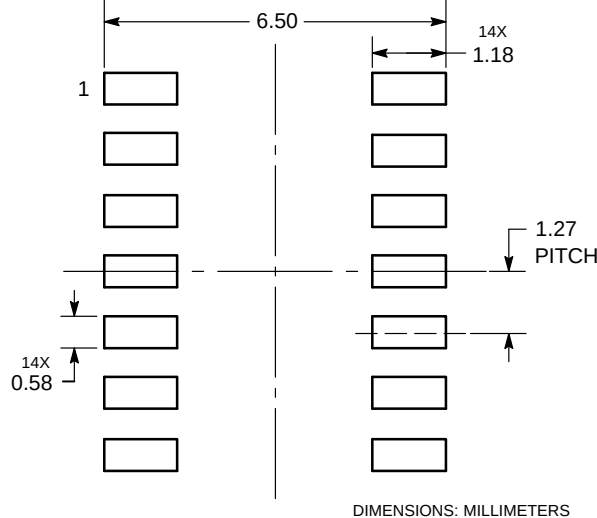


#### NOTES:

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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