

# NL37WZ17

## Triple Noninverting Schmitt-Trigger Buffer

The NL37WZ17 is a high performance buffer with Schmitt-Trigger inputs operating from a 1.65 to 5.5 V supply.

The NL37WZ17 can be used as a line receiver which will receive slow input signals. The NL37WZ17 is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals. In addition, it has a greater noise margin than conventional inverters. The NL37WZ17 has hysteresis between the positive-going and the 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

- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation
- Over Voltage Tolerant Inputs and Outputs
- LVTTTL Compatible – Interface Capability with 5 V TTL Logic with  $V_{CC} = 3$  V
- LVC MOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current Substantially Reduces System Power Requirements
- Current Drive Capability is 24 mA at the Outputs
- Chip Complexity: FET = 94
- 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

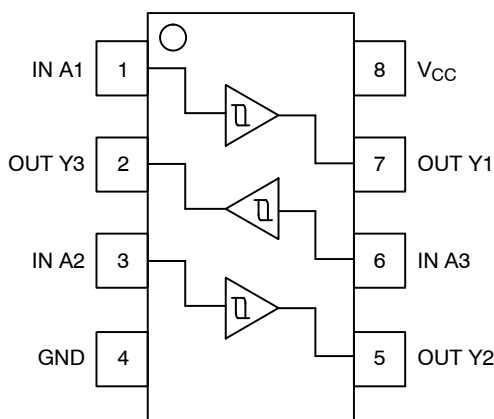


Figure 1. Pinout

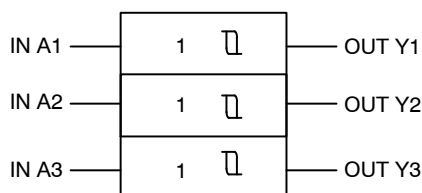


Figure 2. Logic Symbol



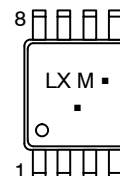
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### MARKING DIAGRAM



**US8**  
**US SUFFIX**  
**CASE 493**



LX = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

### PIN ASSIGNMENT

| Pin | Function |
|-----|----------|
| 1   | IN A1    |
| 2   | OUT Y3   |
| 3   | IN A2    |
| 4   | GND      |
| 5   | OUT Y2   |
| 6   | IN A3    |
| 7   | OUT Y1   |
| 8   | $V_{CC}$ |

### FUNCTION TABLE

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

### ORDERING INFORMATION

| Device        | Package       | Shipping <sup>†</sup> |
|---------------|---------------|-----------------------|
| NL37WZ17USG   | US8 (Pb-Free) | 3000/Tape & Reel      |
| NLV37WZ17USG* | US8 (Pb-Free) | 3000/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

## MAXIMUM RATINGS

| Symbol           | Parameter   | Value                        | Units |
|------------------|---|------------------------------|-------|
| V <sub>CC</sub>  | DC Supply Voltage   | −0.5 to +7.0                 | V     |
| V <sub>I</sub>   | DC Input Voltage  | −0.5 ≤ V <sub>I</sub> ≤ +7.0 | V     |
| V <sub>O</sub>   | DC Output Voltage<br>Output in Z or LOW State (Note 1)  | −0.5 ≤ V <sub>O</sub> ≤ +7.0 | V     |
| I <sub>IK</sub>  | DC Input Diode Current<br>V <sub>I</sub> < GND  | −50                          | mA    |
| I <sub>OK</sub>  | DC Output Diode Current<br>V <sub>O</sub> < GND   | −50                          | mA    |
| I <sub>O</sub>   | DC Output 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 Range   | −65 to +150                  | °C    |
| T <sub>L</sub>   | Lead Temperature, 1 mm from Case for 10 Seconds   | 260                          | °C    |
| T <sub>J</sub>   | Junction Temperature under Bias   | +150                         | °C    |
| θ <sub>JA</sub>  | Thermal Resistance (Note 2)   | 333                          | °C/W  |
| P <sub>D</sub>   | Power Dissipation in Still Air at 85°C  | 200                          | mW    |
| MSL              | Moisture Sensitivity  | Level 1                      |       |
| F <sub>R</sub>   | Flammability Rating<br>Oxygen Index: 28 to 34   | UL 94 V-0 @ 0.125 in         |       |
| V <sub>ESD</sub> | ESD Withstand Voltage<br>Human Body Model (Note 3)<br>Machine Model (Note 4)<br>Charged Device Model (Note 5) | > 2000<br>> 200<br>N/A       | V     |

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. I<sub>O</sub> absolute maximum rating must be observed.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
3. Tested to EIA/JESD22-A114-A.
4. Tested to EIA/JESD22-A115-A.
5. Tested to JESD22-C101-A.

## RECOMMENDED OPERATING CONDITIONS

| Symbol          | Parameter  | Min         | Max                              | Units |
|-----------------|--|-------------|----------------------------------|-------|
| V <sub>CC</sub> | Supply Voltage<br>Operating<br>Data Retention Only   | 2.3<br>1.5  | 5.5<br>5.5                       | V     |
| V <sub>I</sub>  | Input Voltage (Note 6)   | 0           | 5.5                              | V     |
| V <sub>O</sub>  | Output Voltage (HIGH or LOW State)   | 0           | 5.5                              | V     |
| T <sub>A</sub>  | Operating Free-Air Temperature   | −40         | +85                              | °C    |
| Δt/ΔV           | Input Transition Rise or Fall Rate<br>V <sub>CC</sub> = 2.5 V ±0.2 V<br>V <sub>CC</sub> = 3.0 V ±0.3 V<br>V <sub>CC</sub> = 5.0 V ±0.5 V | 0<br>0<br>0 | No Limit<br>No Limit<br>No Limit | ns/V  |

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.

# DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter   | Condition  | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C |                 |      | -40°C ≤ T <sub>A</sub> ≤ 85°C |      | Units |
|------------------|---|--|------------------------|-----------------------|-----------------|------|-------------------------------|------|-------|
|                  |   |  |                        | Min                   | Typ             | Max  | Min                           | Max  |       |
| V <sub>T+</sub>  | Positive Input Threshold Voltage  |  | 2.3                    | 1.0                   | 1.5             | 1.8  | 1.0                           | 1.8  | V     |
|                  |   |  | 2.7                    | 1.2                   | 1.7             | 2.0  | 1.2                           | 2.0  |       |
|                  |   |  | 3.0                    | 1.3                   | 1.9             | 2.2  | 1.3                           | 2.2  |       |
|                  |   |  | 4.5                    | 1.9                   | 2.7             | 3.1  | 1.9                           | 3.1  |       |
|                  |   |  | 5.5                    | 2.2                   | 3.3             | 3.6  | 2.2                           | 3.6  |       |
| V <sub>T-</sub>  | Negative Input Threshold Voltage  |  | 2.3                    | 0.4                   | 0.75            | 1.15 | 0.4                           | 1.15 | V     |
|                  |   |  | 2.7                    | 0.5                   | 0.87            | 1.4  | 0.5                           | 1.4  |       |
|                  |   |  | 3.0                    | 0.6                   | 1.0             | 1.5  | 0.6                           | 1.5  |       |
|                  |   |  | 4.5                    | 1.0                   | 1.5             | 2.0  | 1.0                           | 2.0  |       |
|                  |   |  | 5.5                    | 1.2                   | 1.9             | 2.3  | 1.2                           | 2.3  |       |
| V <sub>H</sub>   | Input Hysteresis Voltage  |  | 2.3                    | 0.25                  | 0.75            | 1.1  | 0.25                          | 1.1  | V     |
|                  |   |  | 2.7                    | 0.3                   | 0.83            | 1.15 | 0.3                           | 1.15 |       |
|                  |   |  | 3.0                    | 0.4                   | 0.93            | 1.2  | 0.4                           | 1.2  |       |
|                  |   |  | 4.5                    | 0.6                   | 1.2             | 1.5  | 0.6                           | 1.5  |       |
|                  |   |  | 5.5                    | 0.7                   | 1.4             | 1.7  | 0.7                           | 1.7  |       |
| V <sub>OH</sub>  | High-Level Output Voltage<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OH</sub> = -100 μA                              | 1.65 to 5.5            | V <sub>CC</sub> - 0.1 | V <sub>CC</sub> |      | V <sub>CC</sub> - 0.1         |      | V     |
|                  |   | I <sub>OH</sub> = -3 mA                                | 1.65                   | 1.29                  | 1.52            |      | 1.29                          |      |       |
|                  |   | I <sub>OH</sub> = -8 mA                                | 2.3                    | 1.9                   | 2.1             |      | 1.9                           |      |       |
|                  |   | I <sub>OH</sub> = -12 mA                               | 2.7                    | 2.2                   | 2.4             |      | 2.2                           |      |       |
|                  |   | I <sub>OH</sub> = -16 mA                               | 3.0                    | 2.4                   | 2.7             |      | 2.4                           |      |       |
|                  |   | I <sub>OH</sub> = -24 mA                               | 3.0                    | 2.3                   | 2.5             |      | 2.3                           |      |       |
|                  |   | I <sub>OH</sub> = -32 mA                               | 4.5                    | 3.8                   | 4.0             |      | 3.8                           |      |       |
| V <sub>OL</sub>  | Low-Level Output Voltage<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  | I <sub>OL</sub> = 100 μA                               | 1.65 to 5.5            |                       | 0.08            | 0.1  |                               | 0.1  | V     |
|                  |   | I <sub>OL</sub> = 4 mA                                 | 1.65                   |                       | 0.2             | 0.24 |                               | 0.24 |       |
|                  |   | I <sub>OL</sub> = 8 mA                                 | 2.3                    |                       | 0.22            | 0.3  |                               | 0.3  |       |
|                  |   | I <sub>OL</sub> = 12 mA                                | 2.7                    |                       | 0.28            | 0.4  |                               | 0.4  |       |
|                  |   | I <sub>OL</sub> = 16 mA                                | 3.0                    |                       | 0.38            | 0.4  |                               | 0.4  |       |
|                  |   | I <sub>OL</sub> = 24 mA                                | 3.0                    |                       | 0.42            | 0.55 |                               | 0.55 |       |
|                  |   | I <sub>OL</sub> = 32 mA                                | 4.5                    |                       |                 | 0.55 |                               | 0.55 |       |
| I <sub>IN</sub>  | Input Leakage Current   | V <sub>IN</sub> = 5.5 V or GND                         | 0 to 5.5               |                       |                 | ±0.1 |                               | ±1.0 | μA    |
| I <sub>OFF</sub> | Power Off Leakage Current   | V <sub>IN</sub> = 5.5 V or<br>V <sub>OUT</sub> = 5.5 V | 0                      |                       |                 | 1    |                               | 10   | μA    |
| I <sub>CC</sub>  | Quiescent Supply Current  | V <sub>IN</sub> = 5.5 V or GND                         | 5.5                    |                       |                 | 1    |                               | 10   | μA    |

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

| Symbol                               | Parameter  | Condition                                      | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C |     |     | -40°C ≤ T <sub>A</sub> ≤ 85°C |     | Units |
|--------------------------------------|--|--|------------------------|-----------------------|-----|-----|-------------------------------|-----|-------|
|                                      |  |  |                        | Min                   | Typ | Max | Min                           | Max |       |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>Input A to Y<br>(Figures 3 and 4) | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF  | 2.5 ± 0.2              | 1.8                   | 4.3 | 7.4 | 1.8                           | 8.1 | ns    |
|                                      |  | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF  | 3.3 ± 0.3              | 1.5                   | 3.3 | 5.0 | 1.5                           | 5.5 |       |
|                                      |  | R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF |                        | 1.8                   | 4.0 | 5.0 | 1.8                           | 6.6 |       |
|                                      |  | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF  | 5.0 ± 0.5              | 1.0                   | 2.7 | 4.1 | 1.0                           | 4.5 |       |
|                                      |  | R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF |                        | 1.2                   | 3.2 | 4.9 | 1.2                           | 5.4 |       |

# CAPACITIVE CHARACTERISTICS

| Symbol          | Parameter                              | Condition  | Typical | Units |
|-----------------|--|--|---------|-------|
| C <sub>IN</sub> | Input Capacitance                      | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>   | 2.5     | pF    |
| C <sub>PD</sub> | Power Dissipation Capacitance (Note 7) | 10 MHz, V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub><br>10 MHz, V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0 V or V <sub>CC</sub> | 9<br>11 | pF    |

7. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

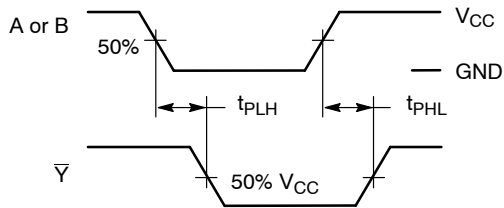
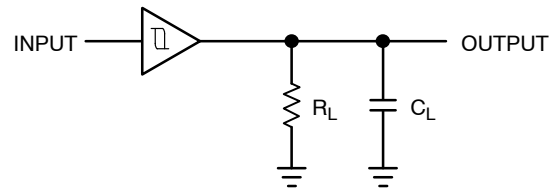


Figure 3. Switching Waveforms



A 1-MHz square input wave is recommended for propagation delay tests.

Figure 4. Test Circuit

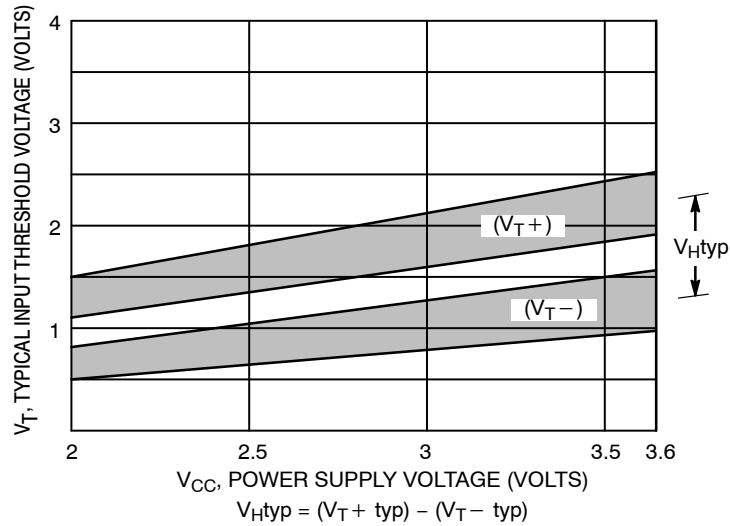
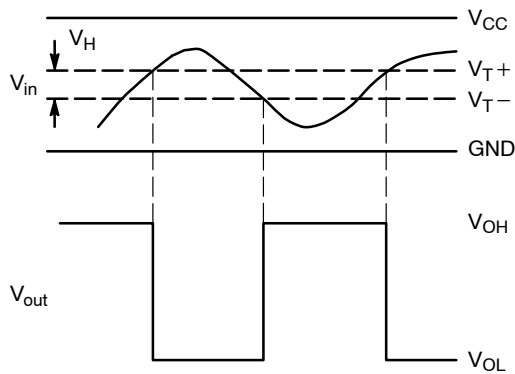
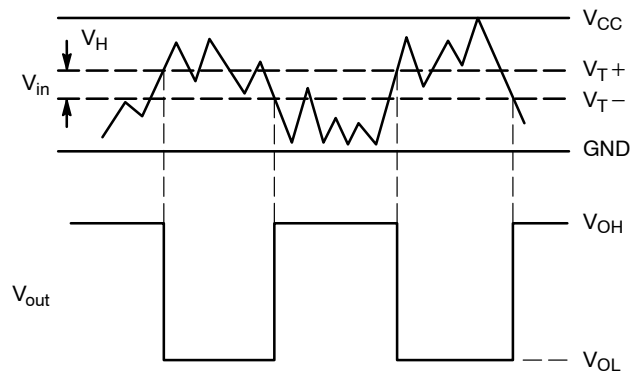


Figure 5. Typical Input Threshold,  $V_{T+}$ ,  $V_{T-}$  versus Power Supply Voltage



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



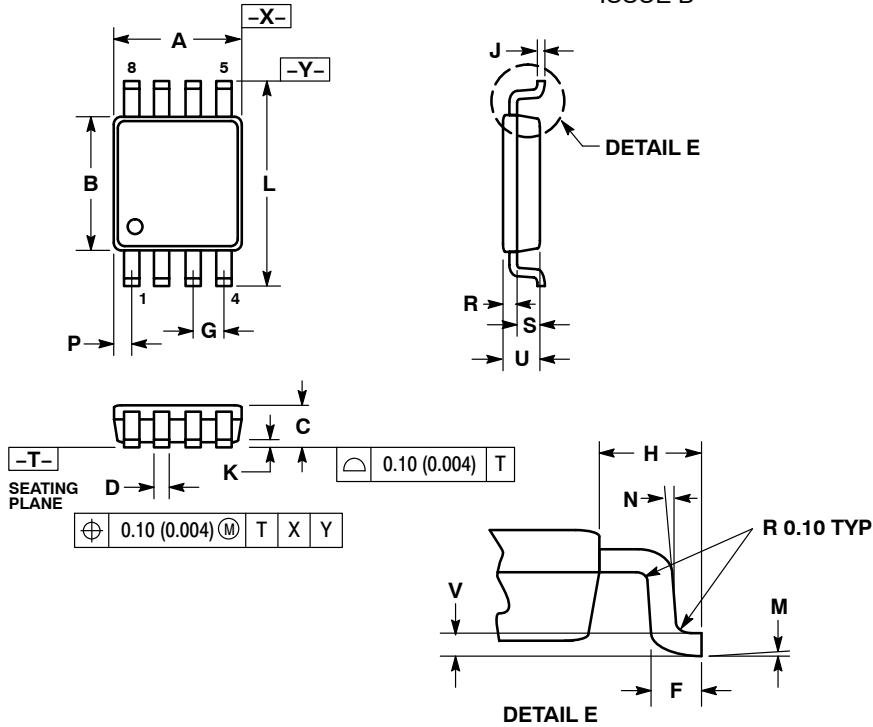
(b) A Schmitt-Trigger Offers Maximum Noise Immunity

Figure 6. Typical Schmitt-Trigger Applications

# NL37WZ17

## PACKAGE DIMENSIONS

US8  
CASE 493-02  
ISSUE B

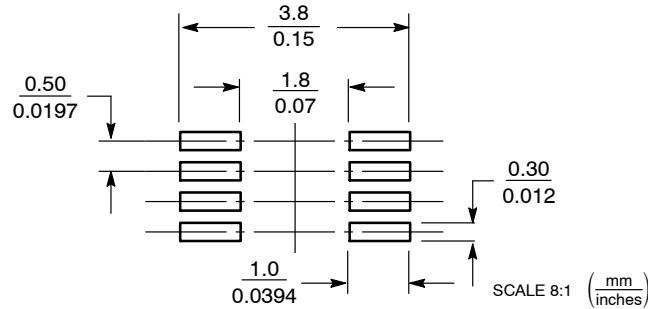


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION "A" DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR. MOLD FLASH, PROTRUSION AND GATE BURR SHALL NOT EXCEED 0.140 MM (0.0055") PER SIDE.
4. DIMENSION "B" DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSION. INTER-LEAD FLASH AND PROTRUSION SHALL NOT EXCEED 0.140 (0.0055") PER SIDE.
5. LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076-0.0203 MM. (300-800 °).
6. ALL TOLERANCE UNLESS OTHERWISE SPECIFIED ±0.0508 (0.0002 ").

| DIM | MIN      | MAX  | MIN       | MAX   |
|-----|----------|------|-----------|-------|
| A   | 1.90     | 2.10 | 0.075     | 0.083 |
| B   | 2.20     | 2.40 | 0.087     | 0.094 |
| C   | 0.60     | 0.90 | 0.024     | 0.035 |
| D   | 0.17     | 0.25 | 0.007     | 0.010 |
| F   | 0.20     | 0.35 | 0.008     | 0.014 |
| G   | 0.50 BSC |      | 0.020 BSC |       |
| H   | 0.40 REF |      | 0.016 REF |       |
| J   | 0.10     | 0.18 | 0.004     | 0.007 |
| K   | 0.00     | 0.10 | 0.000     | 0.004 |
| L   | 3.00     | 3.20 | 0.118     | 0.126 |
| M   | 0°       | 6°   | 0°        | 6°    |
| N   | 5°       | 10°  | 5°        | 10°   |
| P   | 0.23     | 0.34 | 0.010     | 0.013 |
| R   | 0.23     | 0.33 | 0.009     | 0.013 |
| S   | 0.37     | 0.47 | 0.015     | 0.019 |
| U   | 0.60     | 0.80 | 0.024     | 0.031 |
| V   | 0.12 BSC |      | 0.005 BSC |       |

## 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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