

# TinyLogic UHS Triple Buffer with Schmitt Trigger Inputs

## NC7NZ17

### Description

The NC7NZ17 is a triple buffer with Schmitt trigger inputs from onsemi's Ultra High Speed Series of TinyLogic in the US8 package. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a very broad  $V_{CC}$  operating range. The device is specified to operate over the 1.65 V to 5.5 V  $V_{CC}$  range. The inputs and outputs are high impedance when  $V_{CC}$  is 0 V. Inputs tolerate voltages up to 5.5 V independent of  $V_{CC}$  operating voltage. Schmitt trigger inputs typically achieve 1 V hysteresis between the positive going and negative going input threshold voltage at 5 V  $V_{CC}$ .

### Features

- Space Saving US8 Surface Mount Package
- MicroPak™ Pb-Free Leadless Package
- Ultra High Speed:  $t_{PD}$  3.6 ns Typ into 50 pF at 5 V  $V_{CC}$
- High Output Drive:  $\pm 24$  mA at 3 V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range: 1.65 V to 5.5 V
- Power Down High Impedance Inputs / Outputs
- Overvoltage Tolerant Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise / EMI Reduction Circuitry Implemented
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

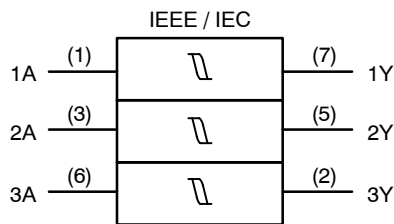
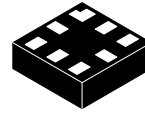
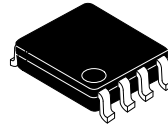


Figure 1. Logic Symbol

### MARKING DIAGRAMS



UQFN8  
1.6X1.6, 0.5P  
CASE 523AY



US8  
CASE 846AN



U4, NZ17 = Specific Device Code  
 KK = 2-Digit Lot Run Traceability Code  
 XY = 2-Digit Date Code Format  
 Z = Assembly Plant Code  
 A = Assembly Site  
 L = Wafer Lot Number  
 YW = Assembly Start Week

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 6 of this data sheet.

Connection Diagrams

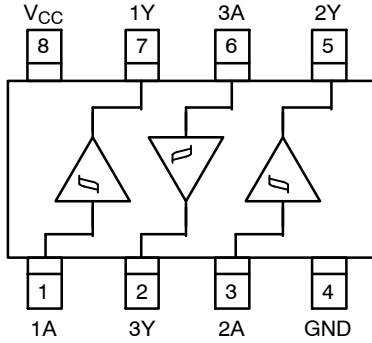


Figure 2. Connection Diagram (Top View)

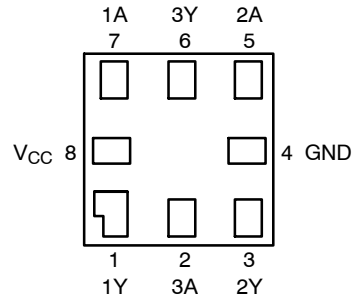
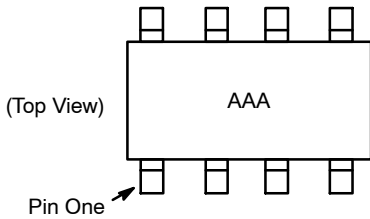


Figure 4. Pad Assignments for MicroPak (Top Thru View)



AAA represents Product Code Top Mark – see ordering code

NOTE: Orientation of Top Mark determines Pin One location. Read the Top Product Code Mark left to right, Pin One is the lower left pin (see diagram).

Figure 3. Pin One Orientation Diagram

PIN DESCRIPTIONS

| Name   | Description |
|--|-------------|
| A <sub>1</sub> , A <sub>2</sub> , A <sub>3</sub> | Data Inputs |
| Y <sub>1</sub> , Y <sub>2</sub> , Y <sub>3</sub> | Output      |

FUNCTION TABLE (Y = A)

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

H = HIGH Logic Level  
L = LOW Logic Level

# NC7NZ17

## ABSOLUTE MAXIMUM RATINGS

| Symbol                             | Parameter   |                        | Min        | Max  | Unit |
|------------------------------------|---|------------------------|------------|------|------|
| V <sub>CC</sub>                    | Supply Voltage                                    |                        | -0.5       | 6.5  | V    |
| V <sub>IN</sub>                    | DC Input Voltage                                  |                        | -0.5       | 6.5  | V    |
| V <sub>OUT</sub>                   | DC Output Voltage                                 |                        | -0.5       | 6.5  | V    |
| I <sub>IK</sub>                    | DC Input Diode Current                            | V <sub>IN</sub> < 0 V  | -          | -50  | mA   |
| I <sub>OK</sub>                    | DC Output Diode Current                           | V <sub>OUT</sub> < 0 V | -          | -50  | mA   |
| I <sub>OUT</sub>                   | DC Output Current                                 |                        | -          | ±50  | mA   |
| I <sub>CC</sub> / I <sub>GND</sub> | DC V <sub>CC</sub> / GND Current                  |                        | -          | ±100 | mA   |
| T <sub>STG</sub>                   | Storage Temperature                               |                        | -65        | +150 | °C   |
| T <sub>J</sub>                     | Junction Temperature under Bias                   |                        | -          | +150 | °C   |
| T <sub>L</sub>                     | Junction Lead Temperature (Soldering, 10 Seconds) |                        | -          | +260 | °C   |
| P <sub>D</sub>                     | Power Dissipation in Still Air                    |                        | US8        | 500  | mW   |
|                                    |   |                        | MicroPak-8 | 539  |      |

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 <sub>CC</sub>  | Supply Voltage Operating      |  | 1.65       | 5.5             | V    |
|                  | Supply Voltage Data Retention |  | 1.5        | 5.5             |      |
| V <sub>IN</sub>  | Input Voltage                 |  | 0          | 5.5             | V    |
| V <sub>OUT</sub> | Output Voltage                |  | 0          | V <sub>CC</sub> | V    |
| T <sub>A</sub>   | Operating Temperature         |  | -40        | +85             | °C   |
| θ <sub>JA</sub>  | Thermal Resistance            |  | US8        | 250             | °C/W |
|                  |                               |  | MicroPak-8 | 232             |      |

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.

1. Unused inputs must be held HIGH or LOW. They may not float.

# NC7NZ17

## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter                  | V <sub>CC</sub> (V) | Conditions                        |   | T <sub>A</sub> = +25°C  |                                   |                              | T <sub>A</sub> = -40 to +85°C |      | Unit |
|------------------|----------------------------|---------------------|-----------------------------------|---|-------------------------|-----------------------------------|------------------------------|-------------------------------|------|------|
|                  |                            |                     |                                   |   | Min                     | Typ                               | Max                          | Min                           | Max  |      |
| V <sub>P</sub>   | Positive Threshold Voltage | 1.65                |                                   |   | -                       | 1.07                              | 1.5                          | -                             | 1.5  | V    |
|                  |                            | 2.3                 |                                   |   | -                       | 1.38                              | 1.8                          | -                             | 1.8  |      |
|                  |                            | 3.0                 |                                   |   | -                       | 1.74                              | 2.2                          | -                             | 2.2  |      |
|                  |                            | 4.5                 |                                   |   | -                       | 2.43                              | 3.1                          | -                             | 3.1  |      |
|                  |                            | 5.5                 |                                   |   | -                       | 2.88                              | 3.6                          | -                             | 3.6  |      |
| V <sub>N</sub>   | Negative Threshold Voltage | 1.65                |                                   |   | 0.25                    | 0.56                              | -                            | 0.25                          | -    | V    |
|                  |                            | 2.3                 |                                   |   | 0.40                    | 0.75                              | -                            | 0.40                          | -    |      |
|                  |                            | 3.0                 |                                   |   | 0.6                     | 0.98                              | -                            | 0.6                           | -    |      |
|                  |                            | 4.5                 |                                   |   | 1.0                     | 1.42                              | -                            | 1.0                           | -    |      |
|                  |                            | 5.5                 |                                   |   | 1.2                     | 1.68                              | -                            | 1.2                           | -    |      |
| V <sub>H</sub>   | Hysteresis Voltage         | 1.65                |                                   |   | 0.15                    | 0.51                              | 1.0                          | 0.15                          | 1.0  | V    |
|                  |                            | 2.3                 |                                   |   | 0.25                    | 0.62                              | 1.1                          | 0.25                          | 1.1  |      |
|                  |                            | 3.0                 |                                   |   | 0.4                     | 0.76                              | 1.2                          | 0.4                           | 1.2  |      |
|                  |                            | 4.5                 |                                   |   | 0.6                     | 1.01                              | 1.5                          | 0.6                           | 1.5  |      |
|                  |                            | 5.5                 |                                   |   | 0.7                     | 1.20                              | 1.7                          | 0.7                           | 1.7  |      |
| V <sub>OH</sub>  | HIGH Level Output Voltage  | 1.65                | V <sub>IN</sub> = V <sub>IH</sub> | I <sub>OH</sub> = -100 μA                   | 1.55                    | 1.65                              | -                            | 1.55                          | -    | V    |
|                  |                            | 2.3                 |                                   |   | 2.2                     | 2.3                               | -                            | 2.2                           | -    |      |
|                  |                            | 3.0                 |                                   |   | 2.9                     | 3.0                               | -                            | 2.9                           | -    |      |
|                  |                            | 4.5                 |                                   |   | 4.4                     | 4.5                               | -                            | 4.4                           | -    |      |
|                  |                            | 1.65                |                                   |   | I <sub>OH</sub> = -4 mA | 1.29                              | 1.52                         | -                             | 1.29 |      |
|                  |                            | 2.3                 |                                   | I <sub>OH</sub> = -8 mA                     | 1.9                     | 2.14                              | -                            | 1.9                           | -    |      |
|                  |                            | 3.0                 |                                   | I <sub>OH</sub> = -16 mA                    | 2.4                     | 2.75                              | -                            | 2.4                           | -    |      |
|                  |                            | 3.0                 |                                   | I <sub>OH</sub> = -24 mA                    | 2.3                     | 2.62                              | -                            | 2.3                           | -    |      |
|                  |                            | 4.5                 |                                   | I <sub>OH</sub> = -32 mA                    | 3.8                     | 4.13                              | -                            | 3.8                           | -    |      |
|                  |                            | V <sub>OL</sub>     |                                   | LOW Level Output Voltage                    | 1.65                    | V <sub>IN</sub> = V <sub>IL</sub> | I <sub>OL</sub> = 100 μA     | -                             | 0.0  |      |
| 2.3              | -                          |                     | 0.0                               |   | 0.1                     |                                   |                              | -                             | 0.1  |      |
| 3.0              | -                          |                     | 0.0                               |   | 0.1                     |                                   |                              | -                             | 0.1  |      |
| 4.5              | -                          |                     | 0.0                               |   | 0.1                     |                                   |                              | -                             | 0.1  |      |
| 1.65             | I <sub>OL</sub> = 4 mA     |                     | -                                 |   | 0.08                    |                                   | 0.24                         | -                             | 0.24 |      |
| 2.3              | I <sub>OL</sub> = 8 mA     |                     | -                                 |   | 0.10                    |                                   | 0.3                          | -                             | 0.3  |      |
| 3.0              | I <sub>OL</sub> = 16 mA    |                     | -                                 |   | 0.16                    |                                   | 0.4                          | -                             | 0.4  |      |
| 3.0              | I <sub>OL</sub> = 24 mA    |                     | -                                 |   | 0.24                    |                                   | 0.55                         | -                             | 0.55 |      |
| 4.5              | I <sub>OL</sub> = 32 mA    |                     | -                                 |   | 0.25                    |                                   | 0.55                         | -                             | 0.55 |      |
| I <sub>IN</sub>  | Input Leakage Current      |                     | 1.65 to 5.5                       |   |                         |                                   | V <sub>IN</sub> = 5.5 V, GND | -                             | -    | ±0.1 |
| I <sub>OFF</sub> | Power Off Leakage Current  | 0.0                 |                                   | V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V | -                       | -                                 | 1                            | -                             | 10   | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current   | 1.65 to 5.5         |                                   | V <sub>IN</sub> = 5.5 V, GND                | -                       | -                                 | 1.0                          | -                             | 10   | μA   |

AC ELECTRICAL CHARACTERISTICS

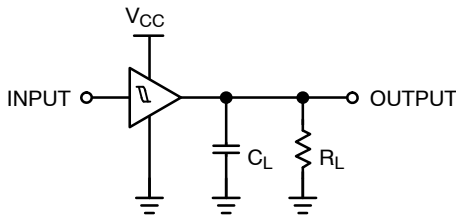
| Symbol                              | Parameter                                   | V <sub>CC</sub> (V) | Conditions  | T <sub>A</sub> = +25°C                             |     |      | T <sub>A</sub> = -40 to +85°C |      | Unit |     |
|-------------------------------------|---|---------------------|---|--|-----|------|-------------------------------|------|------|-----|
|                                     |   |                     |   | Min  | Typ | Max  | Min                           | Max  |      |     |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Propagation Delay<br>(Figure 5, 7)          | 1.8 ±0.15           | C <sub>L</sub> = 15 pF,<br>R <sub>L</sub> = 1 MΩ, | -  | 6.9 | 11.9 | -                             | 13.1 | ns   |     |
|                                     |   | 2.5 ±0.2            |   | -  | 4.8 | 8.2  | -                             | 9.0  |      |     |
|                                     |   | 3.3 ±0.3            |   | -  | 3.7 | 5.6  | -                             | 6.2  |      |     |
|                                     |   | 5.0 ±0.5            |   | -  | 3.0 | 4.7  | -                             | 5.2  |      |     |
|                                     |   | 3.3 ±0.3            |   | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω, | -   | 4.3  | 6.6                           | -    |      | 7.3 |
|                                     |   | 5.0 ±0.5            |   |  | -   | 3.6  | 5.6                           | -    |      | 6.2 |
| C <sub>IN</sub>                     | Input Capacitance                           | 0                   |   | -  | 2.5 | -    | -                             | -    | pF   |     |
| C <sub>PD</sub>                     | Power Dissipation Capacitance<br>(Figure 6) | 3.3                 | (Note 2)  | -  | 9   | -    | -                             | -    | pF   |     |
|                                     |   | 5.0                 |   | -  | 11  | -    | -                             | -    |      |     |

2. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. (See Figure 6). C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression: I<sub>CCD</sub> = (C<sub>PD</sub>) (V<sub>CC</sub>) (f<sub>IN</sub>) + (I<sub>CCstatic</sub>).

AC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter                                   | Conditions   | V <sub>CC</sub> (V) | T <sub>A</sub> = +25°C | Unit |
|------------------|---|--|---------------------|------------------------|------|
|                  |   |  |                     | Typical                |      |
| V <sub>OLP</sub> | Quiet Output Dynamic Peak V <sub>OL</sub>   | C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 5.0 V, V <sub>IL</sub> = 0 V | 5.0                 | 0.8                    | V    |
| V <sub>OLV</sub> | Quiet Output Dynamic Valley V <sub>OL</sub> | C <sub>L</sub> = 50 pF, V <sub>IH</sub> = 5.0 V, V <sub>IL</sub> = 0 V | 5.0                 | -0.8                   | V    |

AC Loading and Waveforms



C<sub>L</sub> includes load and stray capacitance  
Input PRR = 1.0 MHz, t<sub>W</sub> = 500 ns.

Figure 5. AC Test Circuit

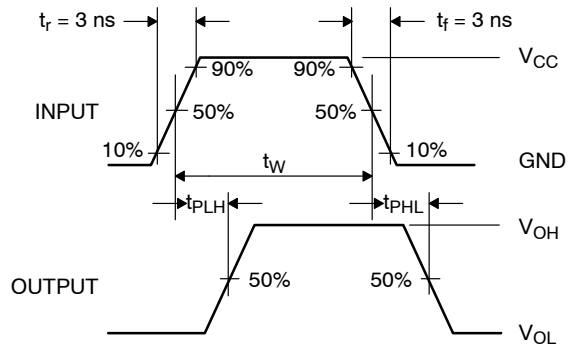
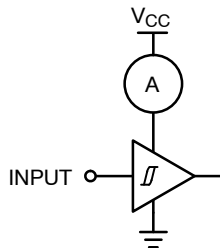


Figure 7. AC Waveforms



Input = AC Waveform; t<sub>r</sub> = t<sub>f</sub> = 1.8 ns;  
PRR = variable; Duty Cycle = 50%.

Figure 6. I<sub>CCD</sub> Test Circuit

# NC7NZ17

## ORDERING INFORMATION

| Part Number       | Top Mark | Package   | Shipping†          |
|-------------------|----------|---|--------------------|
| NC7NZ17K8X        | NZ17     | 8-Lead US8, JEDEC MO-187, Variation CA<br>3.1 mm Wide | 3000 / Tape & Reel |
| NC7NZ17L8X        | U4       | 8-Lead MicroPak, 1.6 mm Wide<br>(Pb-Free)             | 5000 / Tape & Reel |
| NC7NZ17L8X-L22185 | U4       | 8-Lead MicroPak, 1.6 mm Wide<br>(Pb-Free)             | 5000 / Tape & Reel |

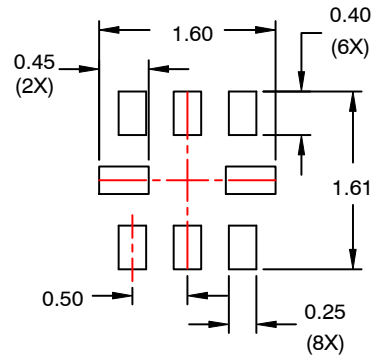
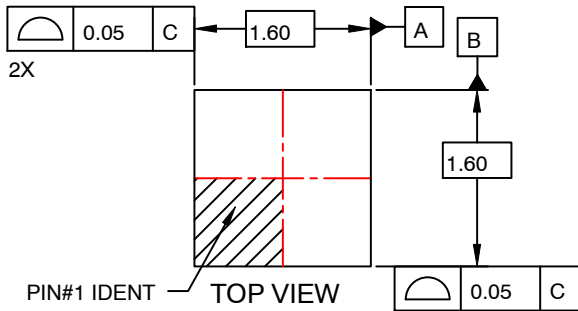
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

3. Pb-Free package per JEDEC J-STD-020B.

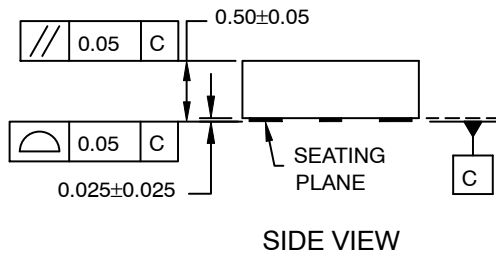
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**UQFN8 1.6X1.6, 0.5P**  
CASE 523AY  
ISSUE O

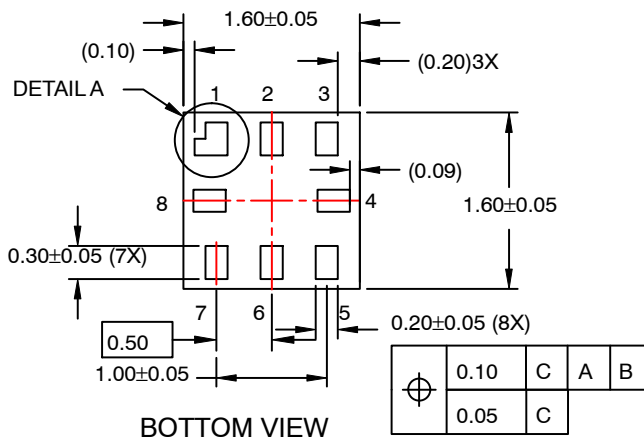
DATE 31 AUG 2016



**RECOMMENDED  
LAND PATTERN**



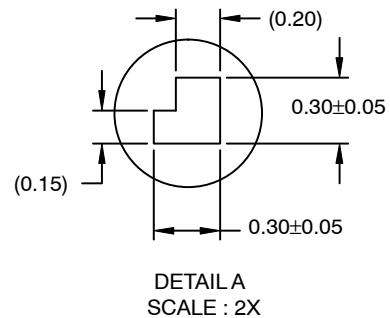
**SIDE VIEW**



**BOTTOM VIEW**

**NOTES:**

- A. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.
- D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.



**DETAIL A  
SCALE : 2X**

|                         |                            |  |
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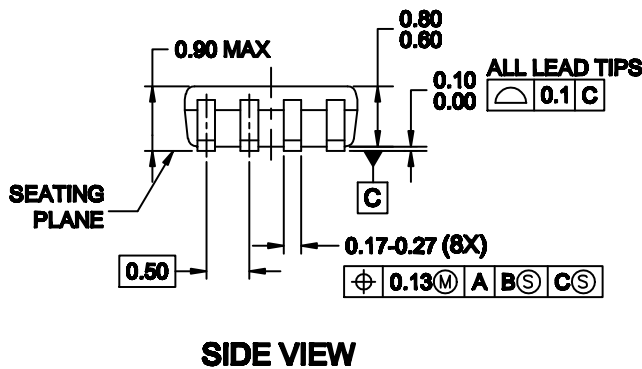
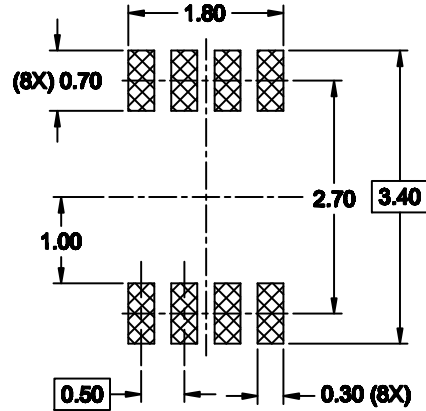
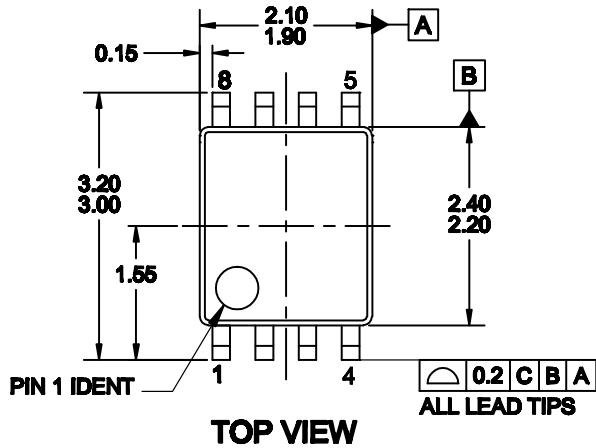
**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

ON Semiconductor®



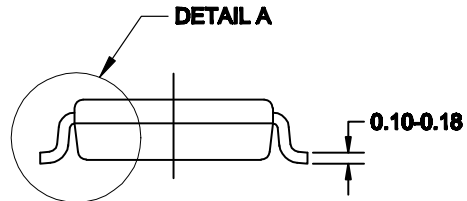
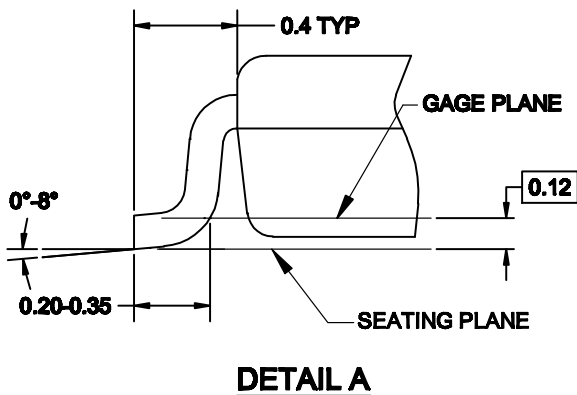
US8  
CASE 846AN  
ISSUE O

DATE 31 DEC 2016



**NOTES:**

- A. CONFORMS TO JEDEC REGISTRATION MO-187
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1994.



|                         |                    |  |
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