

# NC7SZ125

## TinyLogic UHS Buffer with Three-State Output

### Description

The NC7SZ125 is a single buffer with three-state output from ON Semiconductor's Ultra-High Speed (UHS) of TinyLogic. 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 range. The inputs and output are high impedance above ground when  $V_{CC}$  is 0 V. Inputs tolerate voltages up to 5.5 V independent of  $V_{CC}$  operating voltage. The output tolerates voltages above  $V_{CC}$  when in the 3-STATE condition.

### Features

- Ultra-High Speed:  $t_{PD}$  2.6 ns (Typical) 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
- Matches Performance of LCX when Operated at 3.3 V  $V_{CC}$
- Power Down High-Impedance Inputs / Outputs
- Over-Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise / EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Space-Saving SC-74A and SC-88A Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

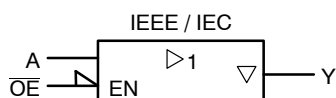


Figure 1. Logic Symbol



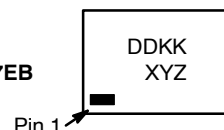
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

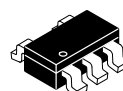
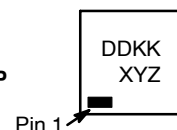
### MARKING DIAGRAMS



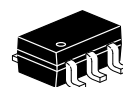
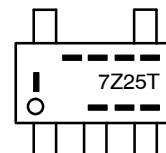
SIP6  
CASE 127EB



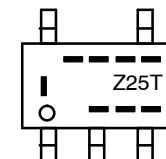
UDFN6  
CASE 517DP



SC-74A  
CASE 318BQ



SC-88A  
CASE 419AC-01



DD, 7Z25, Z25 = Specific Device Code  
KK = 2-Digit Lot Run Traceability Code  
XY = 2-Digit Date Code Format  
Z = Assembly Plant Code  
T = Die Run Code  
---- = Year Coding Scheme  
|-- = Plant Code Identifier  
--- = Eight-Week Datacoding Scheme

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

Pin Configurations

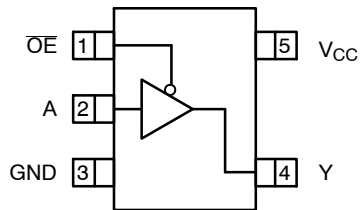


Figure 2. SC-88A and SC-74A (Top View)

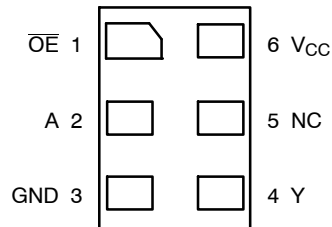


Figure 3. MicroPak (Top Through View)

PIN DEFINITIONS

| Pin # SC-88A / SC74A | Pin # MicroPak | Name            | Description    |
|----------------------|----------------|-----------------|----------------|
| 1                    | 1              | OE              | Input          |
| 2                    | 2              | A               | Input          |
| 3                    | 3              | GND             | Ground         |
| 4                    | 4              | Y               | Output         |
| 5                    | 6              | V <sub>CC</sub> | Supply Voltage |
|                      | 5              | NC              | No Connect     |

FUNCTION TABLE

| Inputs |      | Output |
|--------|------|--------|
| /OE    | In A | Out Y  |
| L      | L    | L      |
| L      | H    | H      |
| H      | X    | Z      |

H = HIGH Logic Level  
 L = LOW Logic Level  
 X = HIGH or LOW Logic Level  
 Z = HIGH Impedance State

## ABSOLUTE MAXIMUM RATINGS

| Symbol                              | Parameter                                         |                                               | Min  | Max  | Unit |
|-------------------------------------|---------------------------------------------------|-----------------------------------------------|------|------|------|
| V <sub>CC</sub>                     | Supply Voltage                                    |                                               | –0.5 | 6.0  | V    |
| V <sub>IN</sub>                     | DC Input Voltage                                  |                                               | –0.5 | 6.0  | V    |
| V <sub>OUT</sub>                    | DC Output Voltage                                 |                                               | –0.5 | 6.0  | V    |
| I <sub>IK</sub>                     | DC Input Diode Current                            | V <sub>IN</sub> < –0.5 V                      | –    | –50  | mA   |
|                                     |                                                   | V <sub>IN</sub> > 6.0 V                       | –    | +20  |      |
| I <sub>OK</sub>                     | DC Output Diode Current                           | V <sub>OUT</sub> < –0.5 V                     | –    | –50  | mA   |
|                                     |                                                   | V <sub>OUT</sub> > 6 V, V <sub>CC</sub> = GND | –    | +20  |      |
| I <sub>OUT</sub>                    | DC Output Current                                 |                                               | –    | ±50  | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current              |                                               | –    | ±50  | mA   |
| T <sub>STG</sub>                    | Storage Temperature Range                         |                                               | –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                    | SC–74A                                        | –    | 225  | mW   |
|                                     |                                                   | SC–88A–5                                      | –    | 190  |      |
|                                     |                                                   | MicroPak–6                                    | –    | 327  |      |
|                                     |                                                   | MicroPak2™–6                                  | –    | 327  |      |
| ESD                                 | Human Body Model, JEDEC: JESD22–A114              |                                               | –    | 4000 | V    |
|                                     | Charge Device Model, JEDEC: JESD22–C101           |                                               | –    | 2000 |      |

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                     | Conditions                             | Min  | Max             | Unit |
|---------------------------------|-------------------------------|----------------------------------------|------|-----------------|------|
| V <sub>CC</sub>                 | Supply Voltage Operating      |                                        | 1.65 | 5.50            | V    |
|                                 | Supply Voltage Data Retention |                                        | 1.50 | 5.50            |      |
| V <sub>IN</sub>                 | Input Voltage                 |                                        | 0    | 5.5             | V    |
| V <sub>OUT</sub>                | Output Voltage                | Active State                           | 0    | V <sub>CC</sub> | V    |
|                                 |                               | Three–State                            | 0    | 5.5             |      |
| T <sub>A</sub>                  | Operating Temperature         |                                        | –40  | +85             | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise and Fall Times     | V <sub>CC</sub> at 1.8 V, 2.5 V ±0.2 V | 0    | 20              | ns/V |
|                                 |                               | V <sub>CC</sub> at 3.3 V ±0.3 V        | 0    | 10              |      |
|                                 |                               | V <sub>CC</sub> at 5.0 V ±0.5 V        | 0    | 5               |      |
| θ <sub>JA</sub>                 | Thermal Resistance            | SC–74A                                 | –    | 555             | °C/W |
|                                 |                               | SC–88A–5                               | –    | 659             |      |
|                                 |                               | MicroPak–6                             | –    | 382             |      |
|                                 |                               | MicroPak2–6                            | –    | 382             |      |

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.

# NC7SZ125

## DC ELECTRICAL CHARACTERISTICS

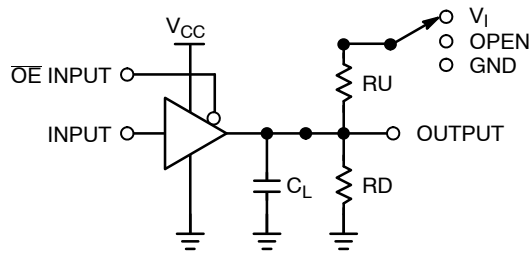
| Symbol           | Parameter                 | V <sub>CC</sub> (V) | Conditions                                                                         | T <sub>A</sub> = +25°C |      |                      | T <sub>A</sub> = -40 to +85°C |                      | Unit |
|------------------|---------------------------|---------------------|------------------------------------------------------------------------------------|------------------------|------|----------------------|-------------------------------|----------------------|------|
|                  |                           |                     |                                                                                    | Min                    | Typ  | Max                  | Min                           | Max                  |      |
| V <sub>IH</sub>  | HIGH Level Input Voltage  | 1.65 to 1.95        |                                                                                    | 0.65 V <sub>CC</sub>   | –    | –                    | 0.65 V <sub>CC</sub>          | –                    | V    |
|                  |                           | 2.30 to 5.50        |                                                                                    | 0.70 V <sub>CC</sub>   | –    | –                    | 0.70 V <sub>CC</sub>          | –                    |      |
| V <sub>IL</sub>  | LOW Level Input Voltage   | 1.65 to 1.95        |                                                                                    | –                      | –    | 0.35 V <sub>CC</sub> | –                             | 0.35 V <sub>CC</sub> | V    |
|                  |                           | 2.30 to 5.50        |                                                                                    | –                      | –    | 0.30 V <sub>CC</sub> | –                             | 0.30 V <sub>CC</sub> |      |
| V <sub>OH</sub>  | HIGH Level Output Voltage | 1.65                | V <sub>IN</sub> = V <sub>IH</sub> ,<br>I <sub>OH</sub> = –100 µA                   | 1.55                   | 1.65 | –                    | 1.55                          | –                    | V    |
|                  |                           | 1.80                |                                                                                    | 1.70                   | 1.80 | –                    | 1.70                          | –                    |      |
|                  |                           | 2.30                |                                                                                    | 2.20                   | 2.30 | –                    | 2.20                          | –                    |      |
|                  |                           | 3.00                |                                                                                    | 2.90                   | 3.00 | –                    | 2.90                          | –                    |      |
|                  |                           | 4.50                |                                                                                    | 4.40                   | 4.50 | –                    | 4.40                          | –                    |      |
|                  |                           | 1.65                | I <sub>OH</sub> = –4 mA                                                            | 1.29                   | 1.52 | –                    | 1.29                          | –                    |      |
|                  |                           | 2.30                | I <sub>OH</sub> = –8 mA                                                            | 1.90                   | 2.15 | –                    | 1.90                          | –                    |      |
|                  |                           | 3.00                | I <sub>OH</sub> = –16 mA                                                           | 2.40                   | 2.80 | –                    | 2.40                          | –                    |      |
|                  |                           | 3.00                | I <sub>OH</sub> = –24 mA                                                           | 2.30                   | 2.68 | –                    | 2.30                          | –                    |      |
|                  |                           | 4.50                | I <sub>OH</sub> = –32 mA                                                           | 3.80                   | 4.20 | –                    | 3.80                          | –                    |      |
| V <sub>OL</sub>  | LOW Level Output Voltage  | 1.65                | V <sub>IN</sub> = V <sub>IL</sub> ,<br>I <sub>OL</sub> = 100 µA                    | –                      | 0.00 | 0.10                 | –                             | 0.00                 | V    |
|                  |                           | 1.80                |                                                                                    | –                      | 0.00 | 0.10                 | –                             | 0.10                 |      |
|                  |                           | 2.30                |                                                                                    | –                      | 0.00 | 0.10                 | –                             | 0.10                 |      |
|                  |                           | 3.00                |                                                                                    | –                      | 0.00 | 0.10                 | –                             | 0.10                 |      |
|                  |                           | 4.50                |                                                                                    | –                      | 0.00 | 0.10                 | –                             | 0.10                 |      |
|                  |                           | 1.65                | I <sub>OL</sub> = 4 mA                                                             | –                      | 0.80 | 0.24                 | –                             | 0.24                 |      |
|                  |                           | 2.30                | I <sub>OL</sub> = 8 mA                                                             | –                      | 0.10 | 0.30                 | –                             | 0.30                 |      |
|                  |                           | 3.00                | I <sub>OL</sub> = 16 mA                                                            | –                      | 0.15 | 0.40                 | –                             | 0.40                 |      |
|                  |                           | 3.00                | I <sub>OL</sub> = 24 mA                                                            | –                      | 0.22 | 0.55                 | –                             | 0.55                 |      |
|                  |                           | 4.50                | I <sub>OL</sub> = 32 mA                                                            | –                      | 0.22 | 0.55                 | –                             | 0.55                 |      |
| I <sub>IN</sub>  | Input Leakage Current     | 1.65 to 5.5         | 0 ≥ V <sub>IN</sub> ≥ 5.5 V                                                        | –                      | –    | ±1                   | –                             | ±10                  | µA   |
| I <sub>OZ</sub>  | 3-STATE Output Leakage    | 0 to 5.5            | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>0 ≥ V <sub>O</sub> ≥ 5.5 V | –                      | –    | ±1                   | –                             | ±10                  | µA   |
| I <sub>OFF</sub> | Power Off Leakage Current | 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 5.50        | V <sub>IN</sub> = 5.5 V, GND                                                       | –                      | –    | 2                    | –                             | 20                   | 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 (Figure 4, 6)                   | 1.65                | C <sub>L</sub> = 15 pF,<br>R <sub>D</sub> = 1 MΩ<br>S <sub>1</sub> = OPEN                                                                                                                                                  | –                      | 6.4 | 13.2 | –                             | 13.8 | ns   |
|                                     |                                                   | 1.80                |                                                                                                                                                                                                                            | –                      | 5.3 | 11.0 | –                             | 11.5 |      |
|                                     |                                                   | 2.50 ±0.20          |                                                                                                                                                                                                                            | –                      | 3.4 | 7.5  | –                             | 8.0  |      |
|                                     |                                                   | 3.30 ±0.30          |                                                                                                                                                                                                                            | –                      | 2.5 | 5.2  | –                             | 5.5  |      |
|                                     |                                                   | 5.00 ±0.50          |                                                                                                                                                                                                                            | –                      | 2.1 | 4.5  | –                             | 4.8  |      |
|                                     |                                                   | 3.30 ±0.30          | C <sub>L</sub> = 50 pF,<br>R <sub>D</sub> = 500 Ω<br>S <sub>1</sub> = OPEN                                                                                                                                                 | –                      | 3.2 | 5.7  | –                             | 6.0  |      |
|                                     |                                                   | 5.00 ±0.50          |                                                                                                                                                                                                                            | –                      | 2.6 | 5.0  | –                             | 5.3  |      |
| t <sub>PZL</sub> , t <sub>PZH</sub> | Output Enable Time (Figure 4, 6)                  | 1.65                | C <sub>L</sub> = 50 pF,<br>R <sub>D</sub> = 500 Ω<br>R <sub>U</sub> = 500 Ω<br>S <sub>1</sub> = GND for t <sub>PZH</sub><br>S <sub>1</sub> = V <sub>IN</sub> for t <sub>PZL</sub><br>V <sub>IN</sub> = 2 · V <sub>CC</sub> | –                      | 8.4 | 15.0 | –                             | 15.6 | ns   |
|                                     |                                                   | 1.80                |                                                                                                                                                                                                                            | –                      | 7.0 | 12.5 | –                             | 13.0 |      |
|                                     |                                                   | 2.50 ±0.20          |                                                                                                                                                                                                                            | –                      | 4.6 | 8.5  | –                             | 9.0  |      |
|                                     |                                                   | 3.30 ±0.30          |                                                                                                                                                                                                                            | –                      | 3.5 | 6.2  | –                             | 6.5  |      |
|                                     |                                                   | 5.00 ±0.50          |                                                                                                                                                                                                                            | –                      | 2.8 | 5.5  | –                             | 5.8  |      |
| t <sub>PLZ</sub> , t <sub>PHZ</sub> | Output Disable Time (Figure 4, 6)                 | 1.65                | C <sub>L</sub> = 50 pF,<br>R <sub>D</sub> = 500 Ω<br>R <sub>U</sub> = 500 Ω<br>S <sub>1</sub> = GND for t <sub>PHZ</sub><br>S <sub>1</sub> = V <sub>IN</sub> for t <sub>PLZ</sub><br>V <sub>IN</sub> = 2 · V <sub>CC</sub> | –                      | 6.5 | 13.2 | –                             | 14.5 | ns   |
|                                     |                                                   | 1.80                |                                                                                                                                                                                                                            | –                      | 5.4 | 11.0 | –                             | 12.0 |      |
|                                     |                                                   | 2.50 ±0.20          |                                                                                                                                                                                                                            | –                      | 3.5 | 8.0  | –                             | 8.5  |      |
|                                     |                                                   | 3.30 ±0.30          |                                                                                                                                                                                                                            | –                      | 2.8 | 5.7  | –                             | 6.0  |      |
|                                     |                                                   | 5.00 ±0.50          |                                                                                                                                                                                                                            | –                      | 2.1 | 4.7  | –                             | 5.0  |      |
| C <sub>IN</sub>                     | Input Capacitance                                 | 0.00                |                                                                                                                                                                                                                            | –                      | 4   | –    | –                             | –    | pF   |
| C <sub>OUT</sub>                    | Output Capacitance                                | 0.00                |                                                                                                                                                                                                                            | –                      | 8   | –    | –                             | –    |      |
| C <sub>PD</sub>                     | Power Dissipation Capacitance (Note 2) (Figure 5) | 3.30                |                                                                                                                                                                                                                            | –                      | 17  | –    | –                             | –    | pF   |

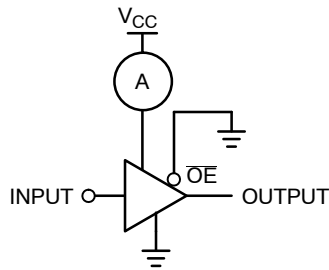
2. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression:  
 $I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CCstatic})$ .

# NC7SZ125



NOTE:  
3.  $C_L$  includes load and stray capacitance;  
Input PRR = 1.0 MHz;  $t_W$  = 500 ns

Figure 4. AC Test Circuit



NOTE:  
4. Input = AC Waveform;  $t_r = t_f = 1.8$  ns;  
PRR = 10 MHz; Duty Cycle = 50%.

Figure 5.  $I_{CCD}$  Test Circuit

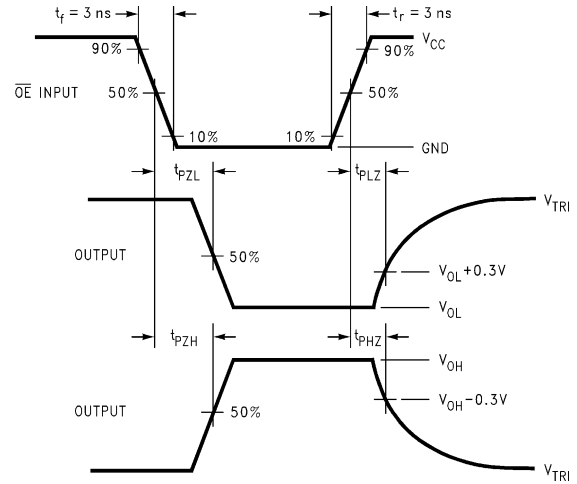
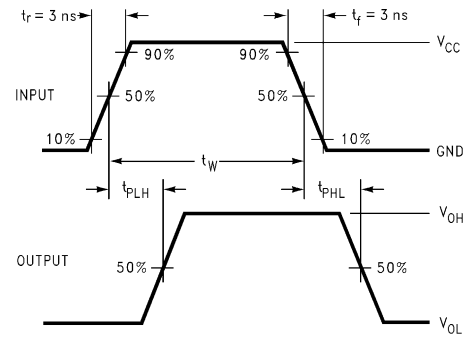


Figure 6. AC Waveforms

## ORDERING INFORMATION

| Part Number | Top Mark | Operating Temperature | Packages  | Shipping <sup>†</sup> |
|-------------|----------|-----------------------|-----------|-----------------------|
| NC7SZ125M5X | 7Z25     | -40 to +85°C          | SC-74A    | 3000 / Tape & Reel    |
| NC7SZ125P5X | Z25      | -40 to +85°C          | SC-88A    | 3000 / Tape & Reel    |
| NC7SZ125L6X | DD       | -40 to +85°C          | MicroPak  | 5000 / Tape & Reel    |
| NC7SZ125FHX | DD       | -40 to +85°C          | MicroPak2 | 5000 / Tape & Reel    |

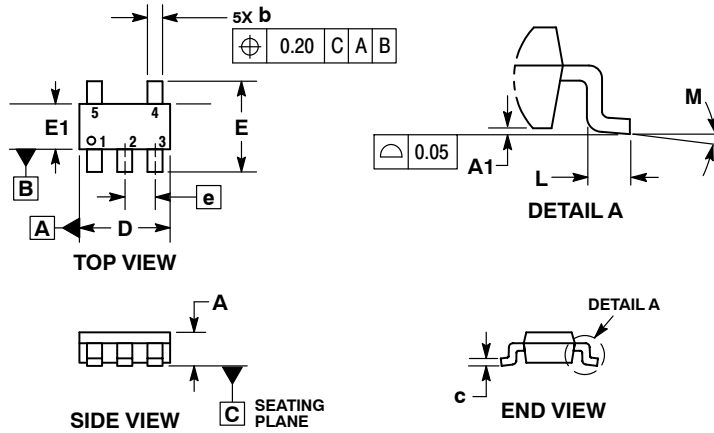
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



# NC7SZ125

## PACKAGE DIMENSIONS

### SC-74A CASE 318BQ ISSUE B

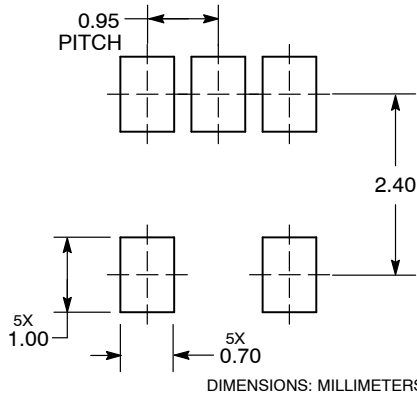


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 0.90        | 1.10 |
| A1  | 0.01        | 0.10 |
| b   | 0.25        | 0.50 |
| c   | 0.10        | 0.26 |
| D   | 2.85        | 3.15 |
| E   | 2.50        | 3.00 |
| E1  | 1.35        | 1.65 |
| e   | 0.95 BSC    |      |
| L   | 0.20        | 0.60 |
| M   | 0°          | 10°  |

#### RECOMMENDED SOLDERING FOOTPRINT\*



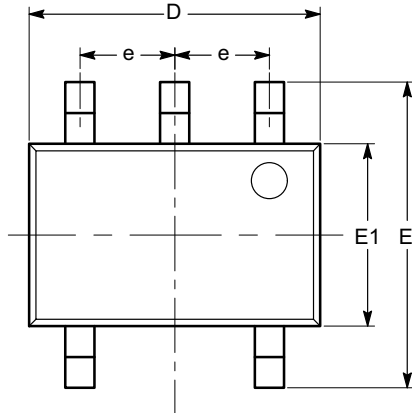
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



# NC7SZ125

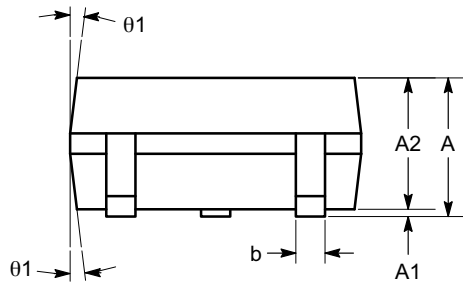
## PACKAGE DIMENSIONS

**SC-88A (SC-70 5 Lead), 1.25x2**  
CASE 419AC-01  
ISSUE A

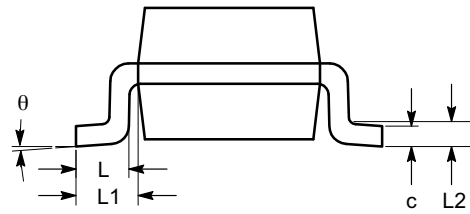


**TOP VIEW**

| SYMBOL     | MIN      | NOM  | MAX  |
|------------|----------|------|------|
| A          | 0.80     |      | 1.10 |
| A1         | 0.00     |      | 0.10 |
| A2         | 0.80     |      | 1.00 |
| b          | 0.15     |      | 0.30 |
| c          | 0.10     |      | 0.18 |
| D          | 1.80     | 2.00 | 2.20 |
| E          | 1.80     | 2.10 | 2.40 |
| E1         | 1.15     | 1.25 | 1.35 |
| e          | 0.65 BSC |      |      |
| L          | 0.26     | 0.36 | 0.46 |
| L1         | 0.42 REF |      |      |
| L2         | 0.15 BSC |      |      |
| $\theta$   | 0°       |      | 8°   |
| $\theta 1$ | 4°       |      | 10°  |



**SIDE VIEW**



**END VIEW**

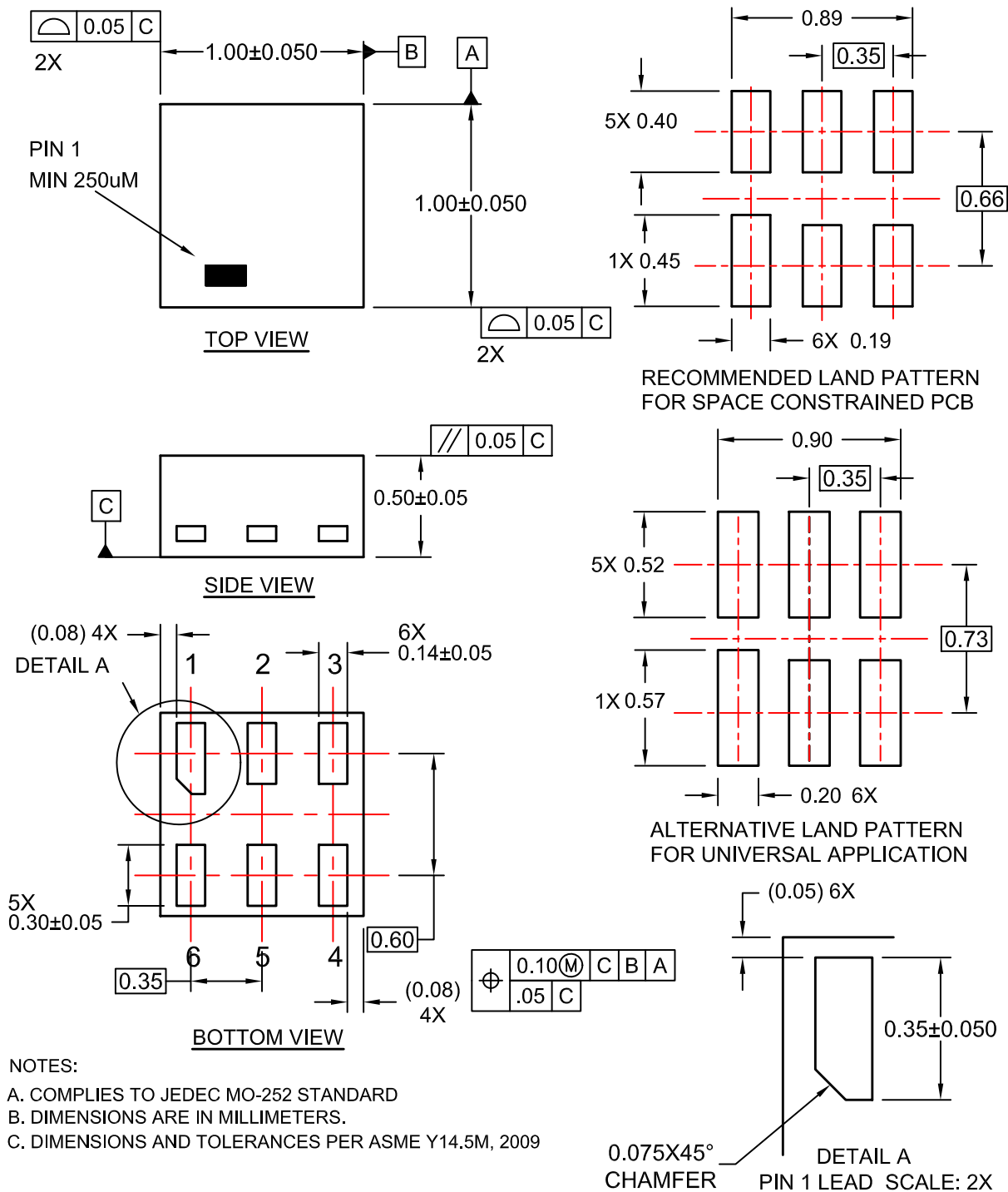
### Notes:

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-203.

# NC7SZ125

## PACKAGE DIMENSIONS

UDFN6 1.0X1.0, 0.35P  
CASE 517DP  
ISSUE O



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