

## 2-Input NAND Gate, Open Drain Output

### NL17SZ38

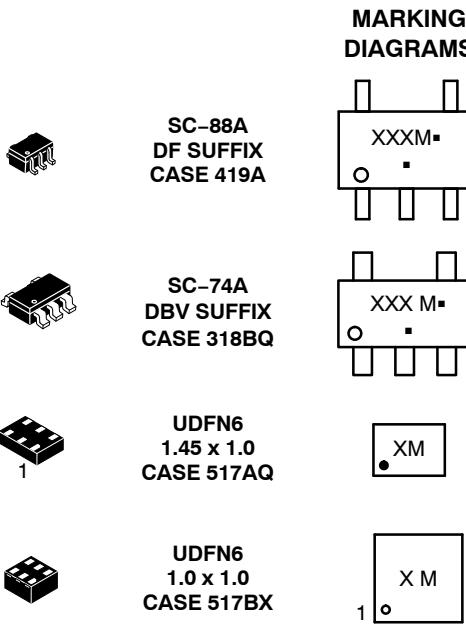
The NL17SZ38 is a single 2-Input NAND gate with open drain output operating from a 1.65 V to 5.5 V supply.

#### Features

- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation
- 2.2 ns  $t_{PD}$  at  $V_{CC} = 5$  V (Typ)
- Inputs/Outputs Overvoltage Tolerant up to 5.5 V
- $I_{OFF}$  Supports Partial Power Down Protection
- Sink 32 mA at 4.5 V
- Available in SC-88, SC-74 and UDFN6 Packages
- Chip Complexity < 100 FETs
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



Figure 1. Logic Symbol



X, XXX = Specific Device Code

M = Date Code\*

▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

#### ORDERING INFORMATION

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

# NL17SZ38

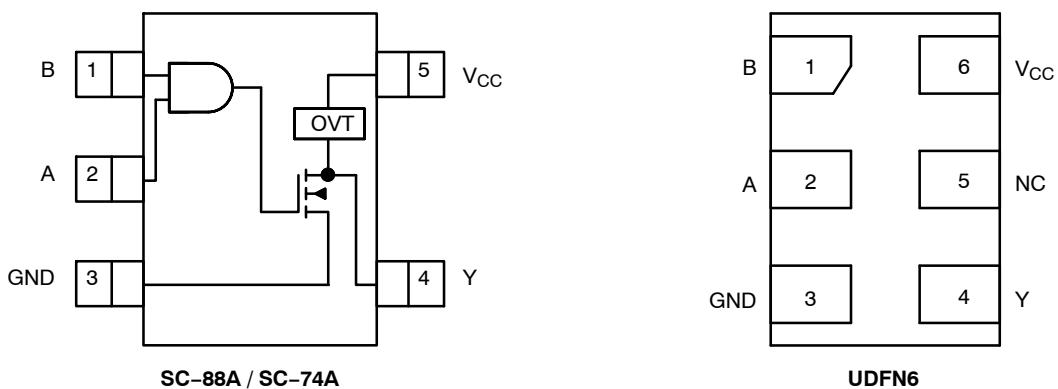


Figure 2. Pinout (Top View)

### PIN ASSIGNMENT (SC-88A/SC-74A)

| Pin | Function        |
|-----|-----------------|
| 1   | B               |
| 2   | A               |
| 3   | GND             |
| 4   | Y               |
| 5   | V <sub>CC</sub> |

### PIN ASSIGNMENT (UDFN)

| Pin | Function        |
|-----|-----------------|
| 1   | B               |
| 2   | A               |
| 3   | GND             |
| 4   | Y               |
| 5   | NC              |
| 6   | V <sub>CC</sub> |

### FUNCTION TABLE

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

## MAXIMUM RATINGS

| Symbol                | Characteristics  | Value  | Unit |
|-----------------------|--|--|------|
| $V_{CC}$              | DC Supply Voltage  | -0.5 to +6.5   | V    |
| $V_{IN}$              | DC Input Voltage   | -0.5 to +6.5   | V    |
| $V_{OUT}$             | DC Output Voltage<br>Active-Mode (High or Low State)<br>Tri-State Mode (Note 1)<br>Power-Down Mode ( $V_{CC} = 0$ V) | -0.5 to $V_{CC} + 0.5$<br>-0.5 to +6.5<br>-0.5 to +6.5 | V    |
| $I_{IK}$              | DC Input Diode Current<br>$V_{IN} < GND$   | -50  | mA   |
| $I_{OK}$              | DC Output Diode Current<br>$V_{OUT} < GND$   | -50  | mA   |
| $I_{OUT}$             | DC Output Source/Sink Current  | $\pm 50$   | mA   |
| $I_{CC}$ or $I_{GND}$ | DC Supply Current per Supply Pin or Ground Pin   | $\pm 100$  | mA   |
| $T_{STG}$             | Storage Temperature Range  | -65 to +150  | °C   |
| $T_L$                 | Lead Temperature, 1 mm from Case for 10 secs   | 260  | °C   |
| $T_J$                 | Junction Temperature Under Bias  | +150   | °C   |
| $\theta_{JA}$         | Thermal Resistance (Note 2)  | SC-88A<br>SC-74A<br>UDFN6<br>377<br>320<br>154         | °C/W |
| $P_D$                 | Power Dissipation in Still Air   | SC-88A<br>SC-74A<br>UDFN6<br>332<br>390<br>812         | mW   |
| MSL                   | Moisture Sensitivity   | Level 1  | -    |
| $F_R$                 | Flammability Rating<br>Oxygen Index: 28 to 34  | UL 94 V-0 @ 0.125 in                                   | -    |
| $V_{ESD}$             | ESD Withstand Voltage (Note 3)<br>Human Body Model<br>Charged Device Model   | 2000<br>1000   | V    |
| $I_{Latchup}$         | Latchup Performance (Note 4)   | $\pm 100$  | mA   |

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.

1. Applicable to devices with outputs that may be tri-stated.
2. Measured with minimum pad spacing on an FR4 board, using 10mm-by-1inch, 2 ounce copper trace no air flow per JESD51-7.
3. HBM tested to ANSI/ESDA/JEDEC JS-001-2017. CDM tested to EIA/JESD22-C101-F. JEDEC recommends that ESD qualification to EIA/JESD22-A115-A (Machine Model) be discontinued per JEDEC/JEP172A.
4. Tested to EIA/JESD78 Class II.

## RECOMMENDED OPERATING CONDITIONS

| Symbol     | Characteristics  | Min              | Max                    | Unit |
|------------|--|------------------|------------------------|------|
| $V_{CC}$   | Positive DC Supply Voltage   | 1.65             | 5.5                    | V    |
| $V_{IN}$   | DC Input Voltage   | 0                | 5.5                    | V    |
| $V_{OUT}$  | DC Output Voltage<br>Active-Mode (High or Low State)<br>Tri-State Mode (Note 1)<br>Power-Down Mode ( $V_{CC} = 0$ V)                           | 0<br>0<br>0      | $V_{CC}$<br>5.5<br>5.5 |      |
| $T_A$      | Operating Temperature Range  | -55              | +125                   | °C   |
| $t_r, t_f$ | Input Rise and Fall Time<br>$V_{CC} = 1.65$ V to 1.95 V<br>$V_{CC} = 2.3$ V to 2.7 V<br>$V_{CC} = 3.0$ V to 3.6 V<br>$V_{CC} = 4.5$ V to 5.5 V | 0<br>0<br>0<br>0 | 20<br>20<br>10<br>5    | ns   |

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                      | Condition   | V <sub>CC</sub> (V)                         | T <sub>A</sub> = 25°C      |   |                                   | -55°C ≤ T <sub>A</sub> ≤ 125°C |   | Units |
|------------------|--------------------------------|---|---|----------------------------|---|-----------------------------------|--------------------------------|---|-------|
|                  |                                |   |   | 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     |
|                  |                                |   | 2.3 to 5.5                                  | 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     |
|                  |                                |   | 2.3 to 5.5                                  | –                          | –   | 0.30 V <sub>CC</sub>              | –                              | 0.30 V <sub>CC</sub>                      |       |
| V <sub>OL</sub>  | Low-Level Output Voltage       | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = 100 µA<br>I <sub>OH</sub> = 4 mA<br>I <sub>OH</sub> = 8 mA<br>I <sub>OH</sub> = 16 mA<br>I <sub>OH</sub> = 24 mA<br>I <sub>OH</sub> = 32 mA | 1.65 to 5.5<br>1.65<br>2.3<br>3<br>3<br>4.5 | –<br>–<br>–<br>–<br>–<br>– | 0.08<br>0.12<br>0.24<br>0.4<br>0.55<br>0.55 | 0.1<br>0.3<br>0.4<br>0.55<br>0.55 | –<br>–<br>–<br>–<br>–          | 0.1<br>0.24<br>0.3<br>0.4<br>0.55<br>0.55 | V     |
| I <sub>IN</sub>  | Input Leakage Current          | V <sub>IN</sub> = 5.5 V or GND  | 1.65 to 5.5                                 | –                          | –   | ±0.1                              | –                              | ±1.0                                      | µA    |
| I <sub>OFF</sub> | Power Off Leakage Current      | V <sub>IN</sub> = 5.5 V or V <sub>OUT</sub> = 5.5 V   | 0   | –                          | –   | 1.0                               | –                              | 10  | µA    |
| I <sub>CC</sub>  | Quiescent Supply Current       | V <sub>IN</sub> = V <sub>CC</sub> or GND  | 5.5   | –                          | –   | 1.0                               | –                              | 10  | µA    |
| I <sub>OZ</sub>  | 3-State Output Leakage Current | V <sub>OUT</sub> = 0 V to 5.5 V   | 1.65 to 5.5                                 | –                          | –   | ±0.5                              | –                              | ±5.0                                      | µA    |

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

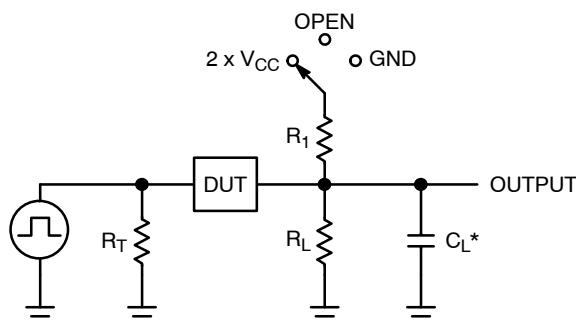
| Symbol           | Parameter                                      | Conditions | V <sub>CC</sub> (V) | T <sub>A</sub> = +25°C |     |      | T <sub>A</sub> = -55 to +125°C |      | Unit |
|------------------|--|------------|---------------------|------------------------|-----|------|--------------------------------|------|------|
|                  |  |            |                     | Min                    | Typ | Max  | Min                            | Max  |      |
| t <sub>PZL</sub> | Propagation Delay, (A or B) to Y (Figure 3, 4) |            | 1.65 to 1.95        | –                      | 6.5 | 12.7 | –                              | 13.2 | ns   |
|                  |  |            | 2.3 to 2.7          | –                      | 3.5 | 7.0  | –                              | 7.5  |      |
|                  |  |            | 3.0 to 3.6          | –                      | 2.8 | 5.0  | –                              | 5.2  |      |
|                  |  |            | 4.5 to 5.5          | –                      | 2.2 | 4.3  | –                              | 4.5  |      |
| t <sub>PLZ</sub> | Propagation Delay, (A or B) to Y (Figure 3, 4) |            | 1.65 to 1.95        | –                      | 5.5 | 12.7 | –                              | 13.2 | ns   |
|                  |  |            | 2.3 to 2.7          | –                      | 3.0 | 7.0  | –                              | 7.5  |      |
|                  |  |            | 3.0 to 3.6          | –                      | 2.1 | 5.0  | –                              | 5.2  |      |
|                  |  |            | 4.5 to 5.5          | –                      | 1.3 | 4.3  | –                              | 4.5  |      |

## CAPACITIVE CHARACTERISTICS

| Symbol           | Parameter                              | Condition   | Typical | Units |
|------------------|--|---|---------|-------|
| C <sub>IN</sub>  | Input Capacitance                      | V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub>         | 2.5     | pF    |
| C <sub>OUT</sub> | Output Capacitance                     | V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub>         | 4.0     | pF    |
| C <sub>PD</sub>  | Power Dissipation Capacitance (Note 5) | 10 MHz, V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub> | 4.0     | pF    |

5. 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:

$$I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CC\text{static}})$$



$C_L$  includes probe and jig capacitance  
 $R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )  
 $f = 1$  MHz

Figure 3. Test Circuit

| Test                | Switch Position   | $C_L$ , pF                   | $R_L$ , $\Omega$ | $R_1$ , $\Omega$ |
|---------------------|-------------------|------------------------------|------------------|------------------|
| $t_{PLH} / t_{PHL}$ | Open              | See AC Characteristics Table |                  |                  |
| $t_{PLZ} / t_{PZL}$ | $2 \times V_{CC}$ | 50                           | 500              | 500              |
| $t_{PHZ} / t_{PZH}$ | GND               | 50                           | 500              | 500              |

X = Don't Care

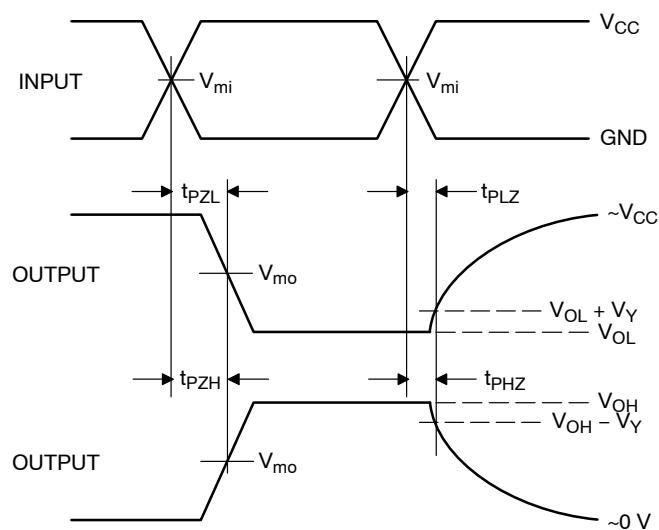
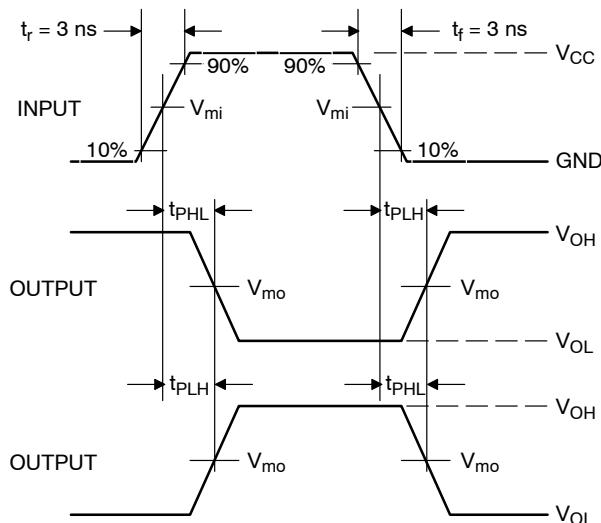


Figure 4. Switching Waveforms

| $V_{CC}$ , V | $V_{mi}$ , V | $V_{mo}$ , V       |                                      | $V_Y$ , V |
|--------------|--------------|--------------------|--------------------------------------|-----------|
|              |              | $t_{PLH}, t_{PHL}$ | $t_{PZL}, t_{PLZ}, t_{PZH}, t_{PHZ}$ |           |
| 1.65 to 1.95 | $V_{CC} / 2$ | $V_{CC} / 2$       | $V_{CC} / 2$                         | 0.15      |
| 2.3 to 2.7   | $V_{CC} / 2$ | $V_{CC} / 2$       | $V_{CC} / 2$                         | 0.15      |
| 3.0 to 3.6   | $V_{CC} / 2$ | $V_{CC} / 2$       | $V_{CC} / 2$                         | 0.3       |
| 4.5 to 5.5   | $V_{CC} / 2$ | $V_{CC} / 2$       | $V_{CC} / 2$                         | 0.3       |

# NL17SZ38

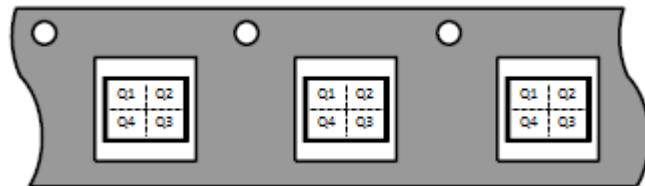
## DEVICE ORDERING INFORMATION

| Device                             | Packages                | Specific Device Code | Pin 1 Orientation<br>(See below) | Shipping <sup>†</sup> |
|------------------------------------|-------------------------|----------------------|----------------------------------|-----------------------|
| NL17SZ38DFT2G<br>(In Development)  | SC-88A                  | TBD                  | Q4                               | 3000 / Tape & Reel    |
| NL17SZ38DBVT1G                     | SC-74A                  | AT                   | Q4                               | 3000 / Tape & Reel    |
| NL17SZ38MU1TCG<br>(In Development) | UDFN6, 1.45 x 1.0, 0.5P | TBD                  | Q4                               | 3000 / Tape & Reel    |
| NL17SZ38MU3TCG<br>(In Development) | UDFN6, 1.0 x 1.0, 0.35P | TBD                  | Q4                               | 3000 / Tape & Reel    |

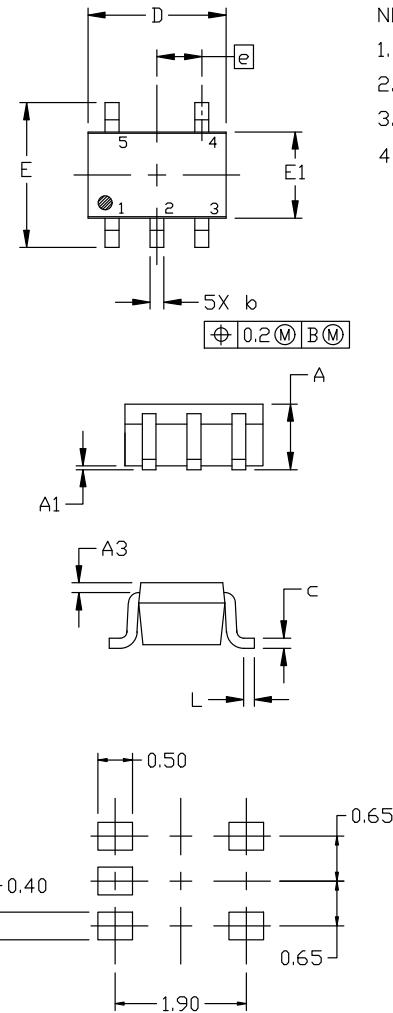
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

### Pin 1 Orientation in Tape and Reel

#### Direction of Feed



## PACKAGE DIMENSIONS

SC-88A (SC-70-5/SOT-353)  
CASE 419A-02  
ISSUE M

## NOTES:

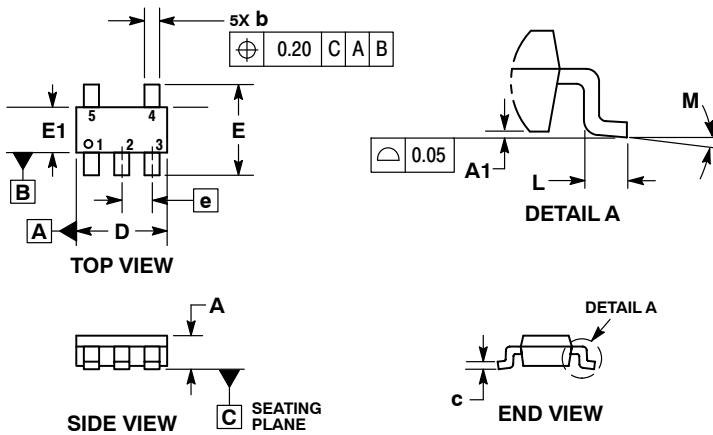
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.1016MM PER SIDE.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.80        | 0.95 | 1.10 |
| A1  | ---         | ---  | 0.10 |
| A3  | 0.20 REF    |      |      |
| b   | 0.10        | 0.20 | 0.30 |
| c   | 0.10        | ---  | 0.25 |
| D   | 1.80        | 2.00 | 2.20 |
| E   | 2.00        | 2.10 | 2.20 |
| E1  | 1.15        | 1.25 | 1.35 |
| e   | 0.65 BSC    |      |      |
| L   | 0.10        | 0.15 | 0.30 |

RECOMMENDED  
MOUNTING 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.

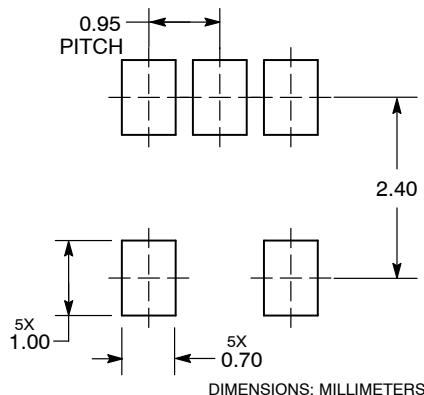
## PACKAGE DIMENSIONS

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.

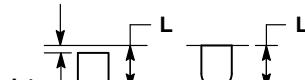
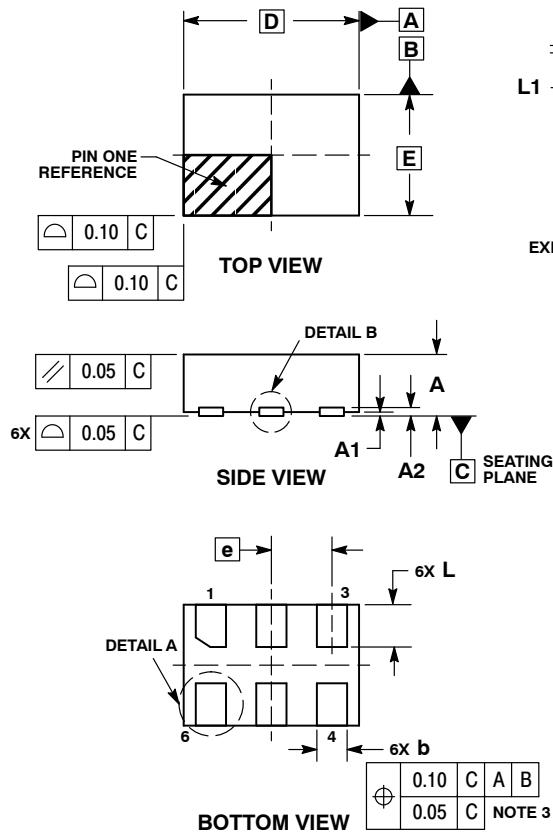
| MILLIMETERS |          |      |
|-------------|----------|------|
| DIM         | MIN      | MAX  |
| A           | 0.90     | 1.10 |
| A1          | 0.01     | 0.10 |
| b           | 0.25     | 0.50 |
| c           | 0.10     | 0.26 |
| D           | 2.85     | 3.15 |
| E           | 2.50     | 3.00 |
| 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 **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## PACKAGE DIMENSIONS

## UDFN6, 1.45x1.0, 0.5P

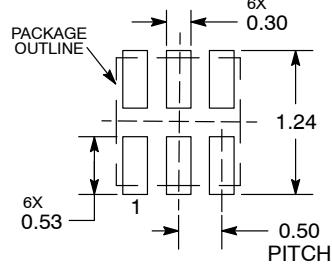
CASE 517AQ  
ISSUE O

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP.

| MILLIMETERS |          |      |
|-------------|----------|------|
| DIM         | MIN      | MAX  |
| A           | 0.45     | 0.55 |
| A1          | 0.00     | 0.05 |
| A2          | 0.07 REF |      |
| b           | 0.20     | 0.30 |
| D           | 1.45 BSC |      |
| E           | 1.00 BSC |      |
| e           | 0.50 BSC |      |
| L           | 0.30     | 0.40 |
| L1          | ---      | 0.15 |

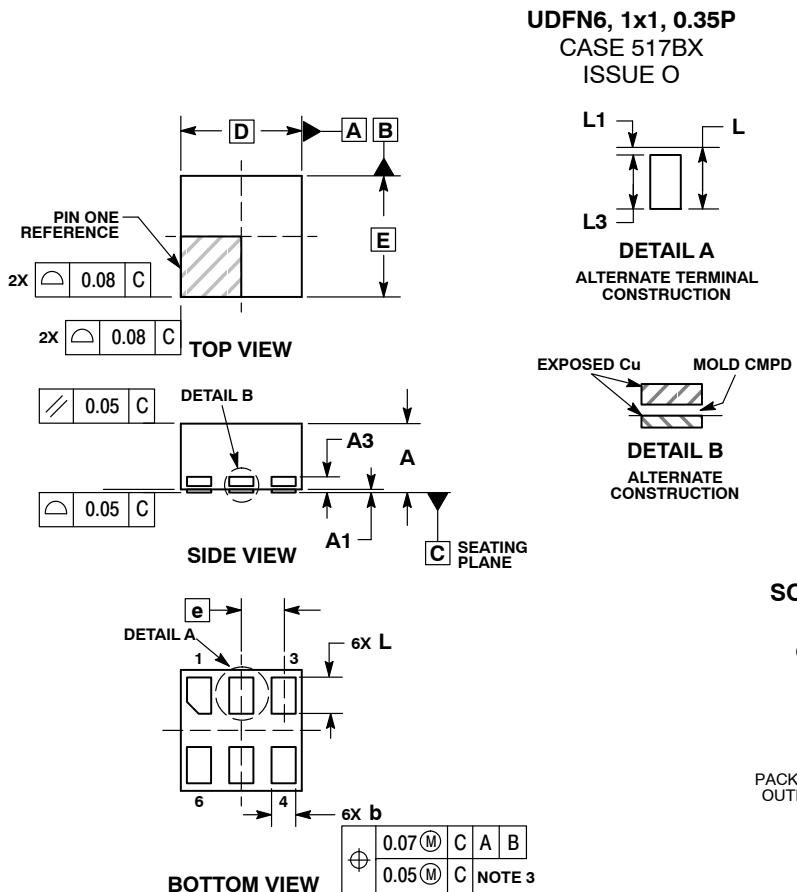
## MOUNTING FOOTPRINT



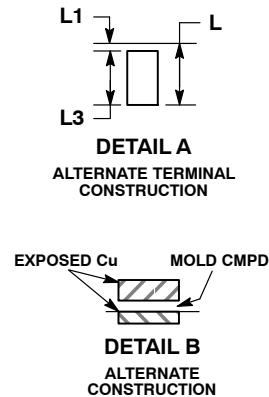
DIMENSIONS: MILLIMETERS

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## PACKAGE DIMENSIONS



**UDFN6, 1x1, 0.35P**  
CASE 517BX  
ISSUE O

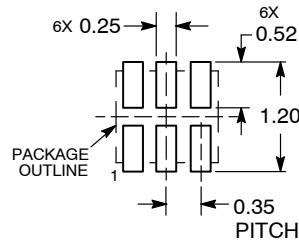


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP.
4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 0.50        | 0.65 |
| A1  | 0.00        | 0.05 |
| A3  | 0.13 REF    |      |
| b   | 0.17        | 0.23 |
| D   | 1.00 BSC    |      |
| E   | 1.00 BSC    |      |
| e   | 0.35        |      |
| L   | 0.20        | 0.40 |
| L1  | ---         | 0.15 |
| L3  | 0.26        | 0.33 |

**RECOMMENDED  
SOLDERING FOOTPRINT\***



DIMENSION: MILLIMETERS

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