

Single Non-Inverting Buffer with Open Drain Output

NL17SZ07

The NL17SZ07 is a single non-inverting buffer with open drain outputs in tiny footprint packages.

Features

- Designed for 1.65 V to 5.5 V V_{CC} Operation
- 2.1 ns t_{PD} at $V_{CC} = 5$ V (typ)
- Input/Output Overvoltage Tolerant up to 5.5 V
- I_{OFF} Supports Partial Power Down Protection
- Sink 24 mA at 3.0 V
- Available in SC-88A, SC-74A, SOT-553, SOT-953 and UDFN6 Packages
- Chip Complexity < 100 FETs
- 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, Halogen Free/BFR Free and are RoHS Compliant

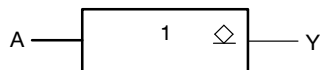


Figure 1. Logic Symbol



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www.onsemi.com

| MARKING DIAGRAMS | | |
|------------------|------------------------------------|--|
| | SC-88A DF SUFFIX CASE 419A | |
| | SC-74A DBV SUFFIX CASE 318BQ | |
| | SOT-553 XV5 SUFFIX CASE 463B | |
| | SOT-953 P5 SUFFIX CASE 527AE | |
| | UDFN6 1.45 x 1.0 CASE 517AQ | |
| | UDFN6 1.0 x 1.0 CASE 517BX | |

XX = Specific Device Code
 M = Date Code*
 ■ = Pb-Free Package

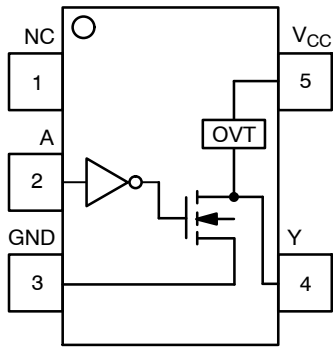
(Note: Microdot may be in either location)

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

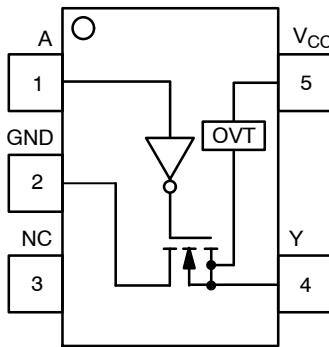
ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 7 of this data sheet.

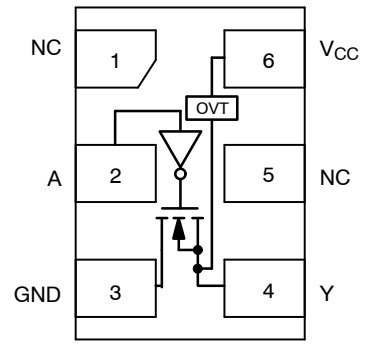
NL17SZ07



(SC-88A/SOT-553/SC-74A)



SOT-953



UDFN6

Figure 2. Pinout (Top View)

PIN ASSIGNMENT

(SC-88A/SOT-553/SC-74A)

| Pin | Function |
|-----|-----------------|
| 1 | NC |
| 2 | A |
| 3 | GND |
| 4 | Y |
| 5 | V _{CC} |

PIN ASSIGNMENT (SOT-953)

| Pin | Function |
|-----|-----------------|
| 1 | A |
| 2 | GND |
| 3 | NC |
| 4 | Y |
| 5 | V _{CC} |

PIN ASSIGNMENT (UDFN6)

| Pin | Function |
|-----|-----------------|
| 1 | NC |
| 2 | A |
| 3 | GND |
| 4 | Y |
| 5 | NC |
| 6 | V _{CC} |

FUNCTION TABLE

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

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MAXIMUM RATINGS

| Symbol | Characteristics | Value | Unit |
|-------------------------------------|--|---|------|
| V _{CC} | DC Supply Voltage SC-74A, SC-88A, SOT-553, SOT-953, UDFN6 SC-88A (NLV) | -0.5 to +7.0 -0.5 to +6.5 | V |
| V _{IN} | DC Input Voltage SC-74A, SC-88A, SOT-553, SOT-953, UDFN6 SC-88A (NLV) | -0.5 to +7.0 -0.5 to +6.5 | V |
| V _{OUT} | DC Output Voltage SC-88A (NLV) Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V _{CC} = 0 V) | -0.5 to V _{CC} + 0.5 -0.5 to +7.0 -0.5 to +7.0 | V |
| | DC Output Voltage SC-74A, SC-88A, SOT-553, SOT-953, UDFN6 Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V _{CC} = 0 V) | -0.5 to V _{CC} + 0.5 -0.5 to +6.5 -0.5 to +6.5 | V |
| I _{IK} | DC Input Diode Current V _{IN} < GND | -50 | mA |
| I _{OK} | DC Output Diode Current V _{OUT} < GND | -50 | mA |
| I _{OUT} | DC Output Source/Sink Current | ±50 | mA |
| I _{CC} or I _{GND} | DC Supply Current per Supply Pin or Ground Pin | ±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 |
| θ _{JA} | Thermal Resistance (Note 2) SC-88A SC-74A SOT-553 SOT-953 UDFN6 | 377 320 324 254 154 | °C/W |
| P _D | Power Dissipation in Still Air SC-88A SC-74A SOT-553 SOT-953 UDFN6 | 332 390 386 491 812 | mW |
| MSL | Moisture Sensitivity | Level 1 | - |
| F _R | Flammability Rating Oxygen Index: 28 to 34 | UL 94 V-0 @ 0.125 in | - |
| V _{ESD} | ESD Withstand Voltage (Note 3) Human Body Model Charged Device Model | 2000 1000 | V |
| I _{Latchup} | Latchup Performance (Note 4) | ± 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.

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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 | 0 | V_{CC} | V | |
| | Active-Mode (High or Low State) | 0 | 5.5 | | |
| | Tri-State Mode (Note 1) Power-Down Mode ($V_{CC} = 0$ V) | 0 | 5.5 | | |
| T_A | Operating Temperature Range | -55 | +125 | °C | |
| t_r, t_f | Input Rise and Fall Time SC-88A (NLV) | $V_{CC} = 3.0$ V to 3.6 V | 0 | 100 | ns/V |
| | | $V_{CC} = 4.5$ V to 5.5 V | 0 | 20 | |
| | Input Rise and Fall Time SC-74A, SC-88A, SOT-553, SOT-953, UDFN6 | $V_{CC} = 1.65$ V to 1.95 V | 0 | 20 | |
| | | $V_{CC} = 2.3$ V to 2.7 V | 0 | 20 | |
| | $V_{CC} = 3.0$ V to 3.6 V | 0 | 10 | | |
| | $V_{CC} = 4.5$ V to 5.5 V | 0 | 5 | | |

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_{CC} (V) | $T_A = 25^\circ\text{C}$ | | | $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ | | Units |
|-----------|--------------------------------|---|-----------------|--------------------------|------|---------------|---|---------------|---------------|
| | | | | Min | Typ | Max | Min | Max | |
| V_{IH} | High-Level Input Voltage | | 1.65 to 1.95 | $0.65 V_{CC}$ | - | - | $0.65 V_{CC}$ | - | V |
| | | | 2.3 to 5.5 | $0.70 V_{CC}$ | - | - | $0.70 V_{CC}$ | - | |
| V_{IL} | Low-Level Input Voltage | | 1.65 to 1.95 | - | - | $0.35 V_{CC}$ | - | $0.35 V_{CC}$ | V |
| | | | 2.3 to 5.5 | - | - | $0.30 V_{CC}$ | - | $0.30 V_{CC}$ | |
| V_{OL} | Low-Level Output Voltage | $V_{IN} = V_{IH}$ or V_{IL} $I_{OL} = 100 \mu\text{A}$ $I_{OL} = 4 \text{ mA}$ $I_{OL} = 8 \text{ mA}$ $I_{OL} = 12 \text{ mA}$ $I_{OL} = 16 \text{ mA}$ $I_{OL} = 24 \text{ mA}$ $I_{OL} = 32 \text{ mA}$ | 1.65 to 5.5 | - | - | 0.1 | - | 0.1 | V |
| | | | 1.65 | - | 0.08 | 0.24 | - | 0.24 | |
| | | | 2.3 | - | 0.2 | 0.3 | - | 0.3 | |
| | | | 2.7 | - | 0.22 | 0.4 | - | 0.4 | |
| | | | 3.0 | - | 0.28 | 0.4 | - | 0.4 | |
| | | | 3.0 | - | 0.38 | 0.55 | - | 0.55 | |
| | | | 4.5 | - | 0.42 | 0.55 | - | 0.55 | |
| I_{IN} | Input Leakage Current | $V_{IN} = 5.5$ V or GND | 1.65 to 5.5 | - | - | ± 0.1 | - | ± 1.0 | μA |
| I_{OZ} | 3-State Output Leakage Current | $V_{OUT} = 0$ V to 5.5 V | 1.65 to 5.5 | - | - | ± 0.5 | - | ± 5.0 | μA |
| I_{OFF} | Power Off Leakage Current | $V_{IN} = 5.5$ V or $V_{OUT} = 5.5$ V | 0 | - | - | 1.0 | - | 10 | μA |
| I_{CC} | Quiescent Supply Current | $V_{IN} = V_{CC}$ or GND | 5.5 | - | - | 1.0 | - | 10 | μA |
| I_{CCT} | Quiescent Supply Current | $V_{IN} = 3.0$ V | 3.6 | - | - | 10 | - | 100 | 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.

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AC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Condition | V _{CC} (V) | T _A = 25°C | | | -55°C ≤ T _A ≤ 125°C | | Units |
|------------------|--|-----------|------------------------|-----------------------|-----|-----|--------------------------------|-----|-------|
| | | | | Min | Typ | Max | Min | Max | |
| t _{PZL} | Propagation Delay, A to Y (Figures 3 and 4) | | 1.65 to 1.95 | – | 6.0 | 9.0 | – | 9.5 | ns |
| | | | 2.3 to 2.7 | – | 3.6 | 6.1 | – | 6.5 | |
| | | | 3.0 to 3.6 | – | 2.7 | 5.6 | – | 6.0 | |
| | | | 4.5 to 5.5 | – | 2.1 | 4.4 | – | 4.8 | |
| t _{PLZ} | Propagation Delay, A to Y (Figures 3 and 4) | | 1.65 to 1.95 | – | 4.0 | 9.0 | – | 9.5 | ns |
| | | | 2.3 to 2.7 | – | 2.8 | 6.1 | – | 6.5 | |
| | | | 3.0 to 3.6 | – | 2.5 | 5.6 | – | 6.0 | |
| | | | 4.5 to 5.5 | | 2.2 | 4.4 | – | 4.8 | |

CAPACITIVE CHARACTERISTICS

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

5. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC(OPR)} = C_{PD} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

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

Figure 3. Test Circuit

| Test | Switch Position | C_L , pF | R_L , Ω | R_1 , Ω |
|---------------------|-------------------|------------------------------|------------------|------------------|
| 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 |

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DEVICE ORDERING INFORMATION

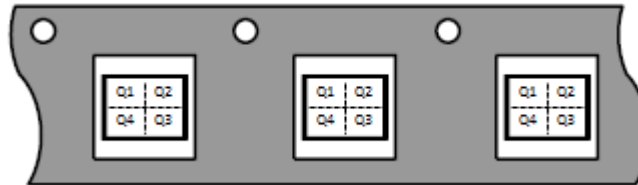
| Device | Packages | Specific Device Code | Pin 1 Orientation (See below) | Shipping† |
|------------------------------------|---------------------------|------------------------|----------------------------------|--------------------|
| NL17SZ07DFT2G | SC-88A | L7 | Q4 | 3000 / Tape & Reel |
| NLV17SZ07DFT2G* | SC-88A | L7 | Q4 | 3000 / Tape & Reel |
| NL17SZ07DBVT1G | SC-74A | AG | Q4 | 3000 / Tape & Reel |
| NL17SZ07XV5T2G | SOT-553 | L7 | Q4 | 4000 / Tape & Reel |
| NL17SZ07P5T5G | SOT-953 | D (Rotated 180° CW) | Q2 | 8000 / Tape & Reel |
| NL17SZ07MU1TCG (In Development) | UDFN6, 1.45 x 1.0 x 0.35P | TBD | Q4 | 3000 / Tape & Reel |
| NL17SZ07MU3TCG (In Development) | UDFN6, 1.0 x 1.0 x 0.35P | TBD | Q4 | 3000 / 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.

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

Pin 1 Orientation in Tape and Reel

Direction of Feed

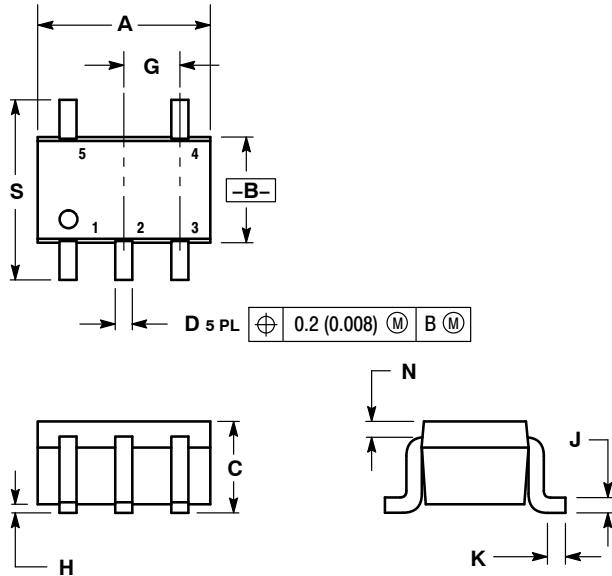


PACKAGE DIMENSIONS

NL17SZ07

PACKAGE DIMENSIONS

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

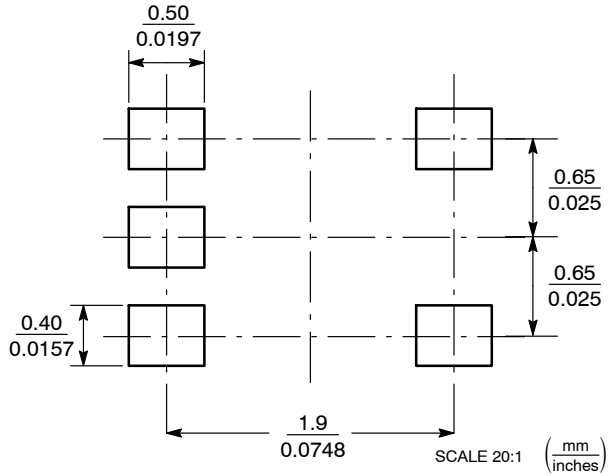


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.071 | 0.087 | 1.80 | 2.20 |
| B | 0.045 | 0.053 | 1.15 | 1.35 |
| C | 0.031 | 0.043 | 0.80 | 1.10 |
| D | 0.004 | 0.012 | 0.10 | 0.30 |
| G | 0.026 BSC | | 0.65 BSC | |
| H | --- | 0.004 | --- | 0.10 |
| J | 0.004 | 0.010 | 0.10 | 0.25 |
| K | 0.004 | 0.012 | 0.10 | 0.30 |
| N | 0.008 REF | | 0.20 REF | |
| S | 0.079 | 0.087 | 2.00 | 2.20 |

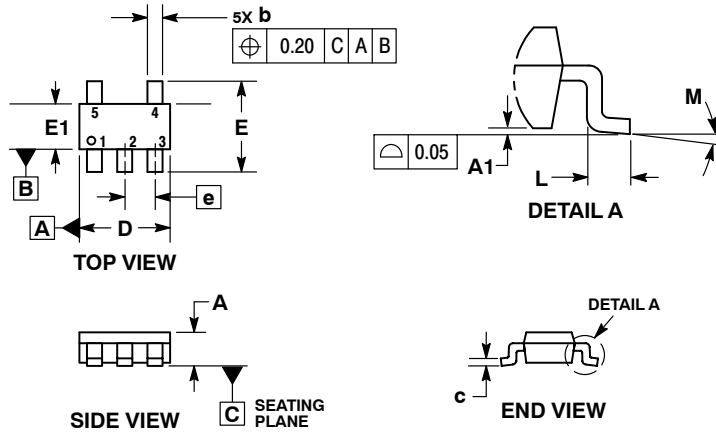
SOLDER FOOTPRINT



NL17SZ07

PACKAGE DIMENSIONS

SC-74A
CASE 318BQ
ISSUE B

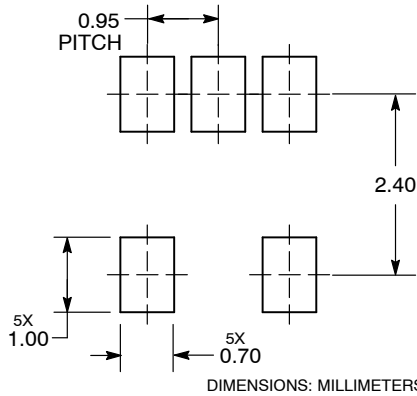


NOTES:

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***



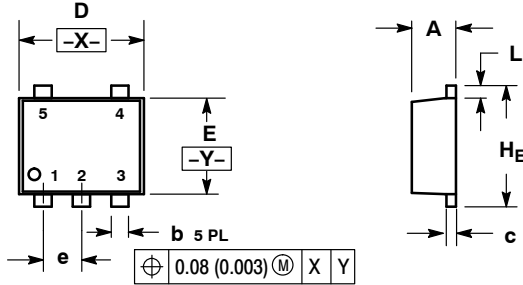
DIMENSIONS: MILLIMETERS

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

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PACKAGE DIMENSIONS

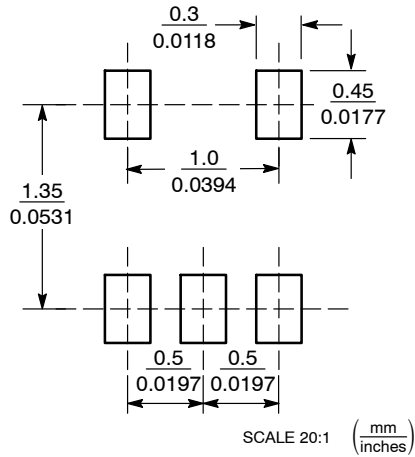
SOT-553, 5 LEAD
CASE 463B
ISSUE C



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETERS
 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

| DIM | MILLIMETERS | | | INCHES | | |
|----------------|-------------|------|------|-----------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.50 | 0.55 | 0.60 | 0.020 | 0.022 | 0.024 |
| b | 0.17 | 0.22 | 0.27 | 0.007 | 0.009 | 0.011 |
| c | 0.08 | 0.13 | 0.18 | 0.003 | 0.005 | 0.007 |
| D | 1.55 | 1.60 | 1.65 | 0.061 | 0.063 | 0.065 |
| E | 1.15 | 1.20 | 1.25 | 0.045 | 0.047 | 0.049 |
| e | 0.50 BSC | | | 0.020 BSC | | |
| L | 0.10 | 0.20 | 0.30 | 0.004 | 0.008 | 0.012 |
| H _E | 1.55 | 1.60 | 1.65 | 0.061 | 0.063 | 0.065 |

RECOMMENDED SOLDERING FOOTPRINT*

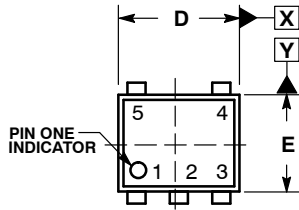


*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

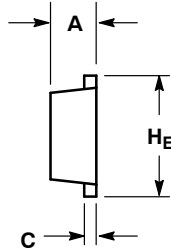
NL17SZ07

PACKAGE DIMENSIONS

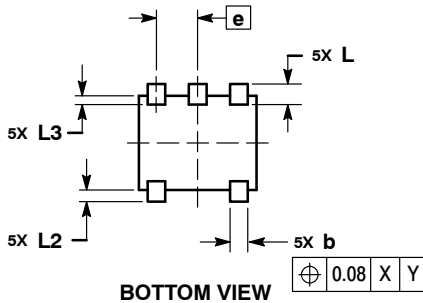
SOT-953
CASE 527AE
ISSUE E



TOP VIEW



SIDE VIEW



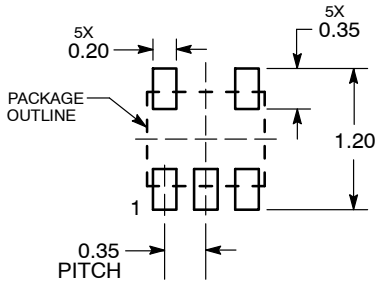
BOTTOM VIEW

NOTES:

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

| DIM | MILLIMETERS | | |
|----------------|-------------|------|------|
| | MIN | NOM | MAX |
| A | 0.34 | 0.37 | 0.40 |
| b | 0.10 | 0.15 | 0.20 |
| C | 0.07 | 0.12 | 0.17 |
| D | 0.95 | 1.00 | 1.05 |
| E | 0.75 | 0.80 | 0.85 |
| e | 0.35 BSC | | |
| H _E | 0.95 | 1.00 | 1.05 |
| L | 0.175 REF | | |
| L2 | 0.05 | 0.10 | 0.15 |
| L3 | --- | --- | 0.15 |

SOLDERING FOOTPRINT*



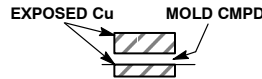
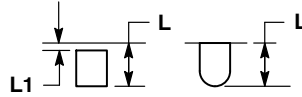
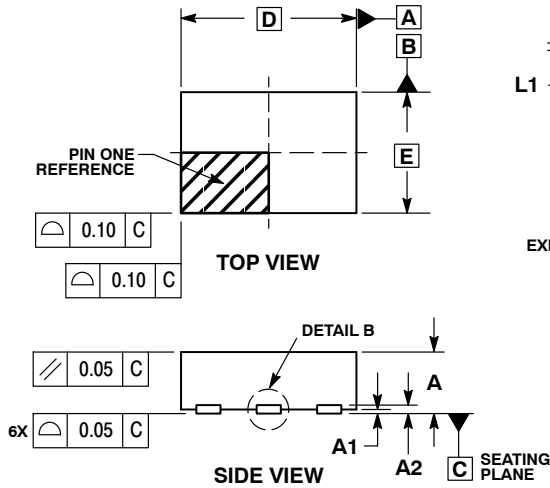
DIMENSIONS: MILLIMETERS

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

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PACKAGE DIMENSIONS

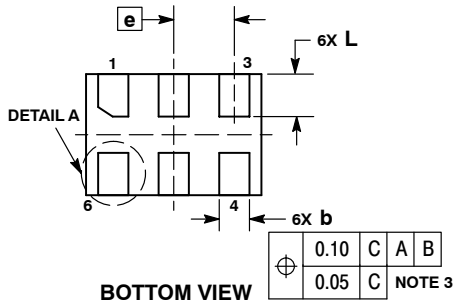
UDFN6, 1.45x1.0, 0.5P
CASE 517AQ
ISSUE O



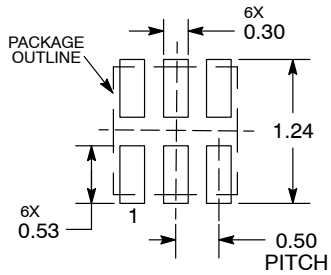
NOTES:

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



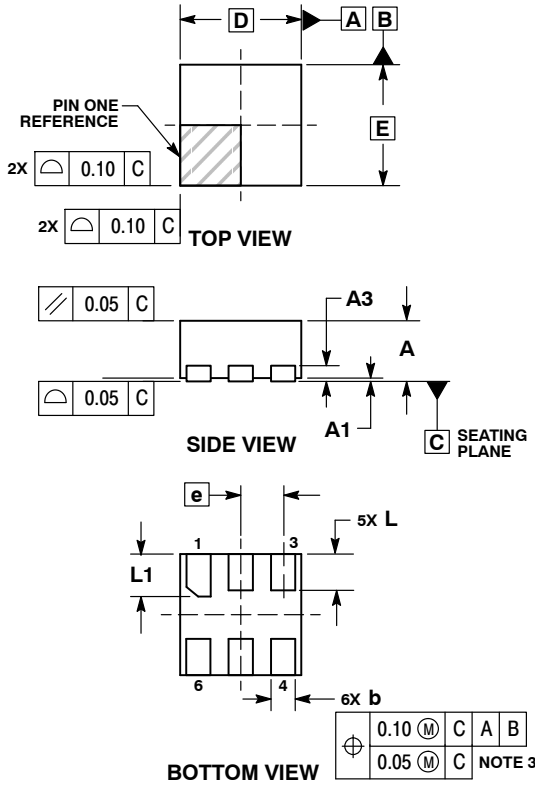
DIMENSIONS: MILLIMETERS

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

NL17SZ07

PACKAGE DIMENSIONS

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

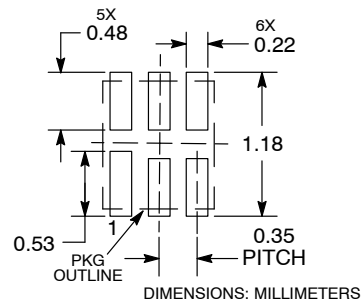


NOTES:

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 | 0.45 | 0.55 |
| A1 | 0.00 | 0.05 |
| A3 | 0.13 | REF |
| b | 0.12 | 0.22 |
| D | 1.00 | BSC |
| E | 1.00 | BSC |
| e | 0.35 | BSC |
| L | 0.25 | 0.35 |
| L1 | 0.30 | 0.40 |

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.

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