

# NL17SZ17

## Single Non-Inverting Buffer with Schmitt Trigger

The NL17SZ17 is a single Non-inverting Schmitt Trigger Buffer in three tiny footprint packages. The device performs much as LCX multi-gate products in speed and drive.

### Features

- Tiny SOT-353, SOT-553 and SOT-953 Packages
- Source/Sink 24 mA at 3.0 Volts
- Chip Complexity: FETs = 20
- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation
- 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

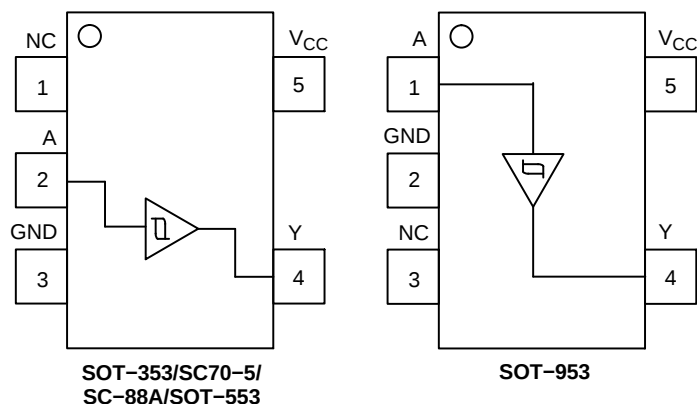


Figure 1. Pinout (Top View)

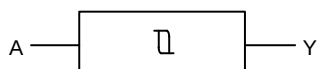


Figure 2. Logic Symbol

### PIN ASSIGNMENT (SOT-353/SC70-5/SC-88A/SOT-553)

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

### PIN ASSIGNMENT (SOT-953)

| Pin | Function |
|-----|----------|
| 1   | IN A     |
| 2   | GND      |
| 3   | NC       |
| 4   | Y        |
| 5   | $V_{CC}$ |

### FUNCTION TABLE

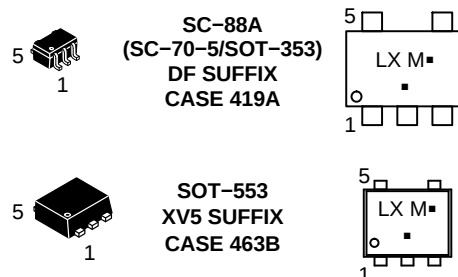
| Input | Output |
|-------|--------|
| A     | Y      |
| L     | L      |
| H     | H      |



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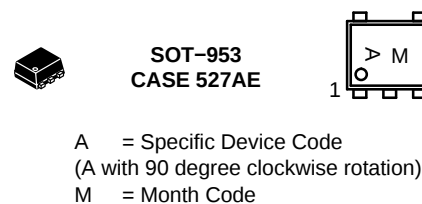
### MARKING DIAGRAMS



LX = 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 and shipping information in the package dimensions section on page 5 of this data sheet.

## MAXIMUM RATINGS

| Symbol        | Parameter                                                                                         | Value                                                                   | Unit |
|---------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|------|
| $V_{CC}$      | DC Supply Voltage                                                                                 | -0.5 to +7.0                                                            | V    |
| $V_I$         | DC Input Voltage                                                                                  | $-0.5 \leq V_I \leq +7.0$                                               | V    |
| $V_O$         | DC Output Voltage<br>(SOT-353/SC70-5/SC-88A/SOT-553 Packages)                                     | Output in High or LOW State (Note 1)<br>Power-Down Mode<br>-0.5 to +7.0 | V    |
| $V_O$         | DC Output Voltage (SOT-953 Package)                                                               | -0.5 to $V_{CC} + 0.5$                                                  | V    |
| $I_{IK}$      | DC Input Diode Current<br>$V_I < GND$                                                             | -50                                                                     | mA   |
| $I_{OK}$      | DC Output Diode Current<br>(SOT-953 Package)<br>$V_O < GND, V_O > V_{CC}$                         | $\pm 50$                                                                | mA   |
| $I_{OK}$      | DC Output Diode Current (SOT-353/SC70-5/SC-88A/SOT-553 Packages)<br>$V_O < GND$                   | -50                                                                     | mA   |
| $I_O$         | DC Output Sink Current                                                                            | $\pm 50$                                                                | mA   |
| $I_{CC}$      | DC Supply Current per Supply Pin                                                                  | $\pm 100$                                                               | mA   |
| $I_{GND}$     | DC Ground Current per Ground Pin                                                                  | $\pm 100$                                                               | mA   |
| $T_{STG}$     | Storage Temperature Range                                                                         | -65 to +150                                                             | °C   |
| $T_L$         | Lead Temperature, 1 mm from Case for 10 Seconds                                                   | 260                                                                     | °C   |
| $T_J$         | Junction Temperature under Bias                                                                   | +150                                                                    | °C   |
| $\theta_{JA}$ | Thermal Resistance<br>SOT-353 (Note 2)<br>SOT-553                                                 | 350<br>496                                                              | °C/W |
| $P_D$         | Power Dissipation in Still Air at 85°C<br>SOT-353<br>SOT-553                                      | 186<br>135                                                              | mW   |
| MSL           | Moisture Sensitivity                                                                              | Level 1                                                                 |      |
| $F_R$         | Flammability Rating<br>Oxygen Index: 28 to 34                                                     | UL 94 V-0 @ 0.125 in                                                    |      |
| ESD           | ESD Classification<br>Human Body Model (Note 3)<br>Machine Model (Note 4)<br>Charged Device Model | Class 2<br>Class C<br>N/A                                               |      |
| $I_{Latchup}$ | Latchup Performance Above $V_{CC}$ and Below GND at 85°C (Note 5)                                 | $\pm 500$                                                               | 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.  $I_O$  absolute maximum rating must be observed.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
3. Tested to EIA/JESD22-A114-A, rated to EIA/JESD22-A114-B.
4. Tested to EIA/JESD22-A115-A, rated to EIA/JESD22-A115-A.
5. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol              | Parameter                                                                                                                                                              | Min                      | Max                              | Unit |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------------------|------|
| $V_{CC}$            | Supply Voltage<br>Operating<br>Data Retention Only                                                                                                                     | 1.65<br>1.5              | 5.5<br>5.5                       | V    |
| $V_I$               | Input Voltage, (Note 6)                                                                                                                                                | 0                        | 5.5                              | V    |
| $V_O$               | Output Voltage<br>(SOT-353/SC70-5/SC-88A/SOT-553 Packages)                                                                                                             | (HIGH or LOW State)<br>0 | 5.5                              | V    |
| $V_O$               | Output Voltage (SOT-953 Package)                                                                                                                                       | (HIGH or LOW State)<br>0 | $V_{CC}$                         | V    |
| $T_A$               | Operating Free-Air Temperature                                                                                                                                         | -55                      | +125                             | °C   |
| $\Delta t/\Delta V$ | Input Transition Rise or Fall Rate<br>$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$<br>$V_{CC} = 3.0\text{ V} \pm 0.3\text{ V}$<br>$V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ | 0<br>0<br>0              | No Limit<br>No Limit<br>No Limit | ns/V |

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.

6. Unused inputs may not be left open. All inputs must be tied to a high-logic voltage level or a low-logic input voltage level.

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## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter                                                                         | Condition                                                                                                                                                                                       | V <sub>CC</sub><br>(V)                                 | T <sub>A</sub> = 25°C                                            |                                                            |                                                                  | -55°C ≤ T <sub>A</sub> ≤ 125°C          |                                           | Units |
|------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------------|-----------------------------------------|-------------------------------------------|-------|
|                  |                                                                                   |                                                                                                                                                                                                 |                                                        | Min                                                              | Typ                                                        | Max                                                              | Min                                     | Max                                       |       |
| V <sub>T+</sub>  | Positive Input Threshold Voltage                                                  |                                                                                                                                                                                                 | 1.65<br>2.3<br>2.7<br>3.0<br>4.5<br>5.5                | 0.6<br>1.0<br>1.2<br>1.3<br>1.9<br>2.2                           | 1.0<br>1.5<br>1.7<br>1.9<br>2.7<br>3.3                     | 1.4<br>1.8<br>2.0<br>2.2<br>3.1<br>3.6                           | 0.6<br>1.0<br>1.2<br>1.3<br>1.9<br>2.2  | 1.4<br>1.8<br>2.0<br>2.2<br>3.1<br>3.6    | V     |
| V <sub>T-</sub>  | Negative Input Threshold Voltage                                                  |                                                                                                                                                                                                 | 1.65<br>2.3<br>2.7<br>3.0<br>4.5<br>5.5                | 0.2<br>0.4<br>0.5<br>0.6<br>1.0<br>1.2                           | 0.5<br>0.75<br>0.87<br>1.0<br>1.5<br>1.9                   | 0.8<br>1.15<br>1.4<br>1.5<br>2.0<br>2.3                          | 0.2<br>0.4<br>0.5<br>0.6<br>1.0<br>1.2  | 0.8<br>1.15<br>1.4<br>1.5<br>2.0<br>2.3   | V     |
| V <sub>H</sub>   | Input Hysteresis Voltage                                                          |                                                                                                                                                                                                 | 1.65<br>2.3<br>2.7<br>3.0<br>4.5<br>5.5                | 0.1<br>0.25<br>0.3<br>0.4<br>0.6<br>0.7                          | 0.48<br>0.75<br>0.83<br>0.93<br>1.2<br>1.4                 | 0.9<br>1.1<br>1.15<br>1.2<br>1.5<br>1.7                          | 0.1<br>0.25<br>0.3<br>0.4<br>0.6<br>0.7 | 0.9<br>1.1<br>1.15<br>1.2<br>1.5<br>1.7   | V     |
| V <sub>OH</sub>  | High-Level Output Voltage<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OH</sub> = -100 μA<br>I <sub>OH</sub> = -3 mA<br>I <sub>OH</sub> = -8 mA<br>I <sub>OH</sub> = -12 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>2.7<br>3.0<br>3.0<br>4.5 | V <sub>CC</sub> - 0.1<br>1.29<br>1.9<br>2.2<br>2.4<br>2.3<br>3.8 | V <sub>CC</sub><br>1.52<br>2.1<br>2.4<br>2.7<br>2.5<br>4.0 | V <sub>CC</sub> - 0.1<br>1.29<br>1.9<br>2.2<br>2.4<br>2.3<br>3.8 |                                         |                                           | V     |
| V <sub>OL</sub>  | Low-Level Output Voltage<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  | I <sub>OL</sub> = 100 μA<br>I <sub>OL</sub> = 3 mA<br>I <sub>OL</sub> = 8 mA<br>I <sub>OL</sub> = 12 mA<br>I <sub>OL</sub> = 16 mA<br>I <sub>OL</sub> = 24 mA<br>I <sub>OL</sub> = 32 mA        | 1.65 to 5.5<br>1.65<br>2.3<br>2.7<br>3.0<br>3.0<br>4.5 |                                                                  | 0.08<br>0.2<br>0.22<br>0.28<br>0.38<br>0.42                | 0.1<br>0.24<br>0.3<br>0.4<br>0.55<br>0.55                        |                                         | 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                                                                                                                                                                  | 0 to 5.5                                               |                                                                  |                                                            | ±0.1                                                             |                                         | ±1.0                                      | μA    |
| I <sub>OFF</sub> | Power Off Leakage Current (SOT-353/ SC70-5/SC-88A/ SOT-553 Packages)              | 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> = 5.5 V or GND                                                                                                                                                                  | 5.5                                                    |                                                                  |                                                            | 1.0                                                              |                                         | 10                                        | μA    |

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

| Symbol                               | Parameter                                              | Condition                                      | V <sub>CC</sub><br>(V)                             | T <sub>A</sub> = 25°C           |                                 |                                 | -55°C ≤ T <sub>A</sub> ≤ 125°C  |                                 | Units |
|--------------------------------------|--------------------------------------------------------|------------------------------------------------|----------------------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-------|
|                                      |                                                        |                                                |                                                    | Min                             | Typ                             | Max                             | Min                             | Max                             |       |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>Input A to Y<br>(Figures 3 and 4) | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF  | 1.65<br>1.8<br>2.5 ± 0.2<br>3.3 ± 0.3<br>5.0 ± 0.5 | 2.0<br>2.0<br>1.0<br>1.0<br>0.5 | 9.1<br>7.6<br>5.0<br>3.7<br>3.1 | 15<br>12.5<br>9.0<br>6.3<br>5.2 | 2.0<br>2.0<br>1.0<br>1.0<br>0.5 | 15.6<br>13<br>9.5<br>6.5<br>5.5 | ns    |
|                                      |                                                        | R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF | 3.3 ± 0.3<br>5.0 ± 0.5                             | 1.5<br>0.8                      | 4.4<br>3.7                      | 7.2<br>5.9                      | 1.5<br>0.8                      | 7.5<br>6.2                      |       |

## CAPACITIVE CHARACTERISTICS

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

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

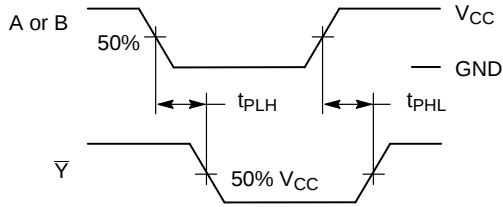
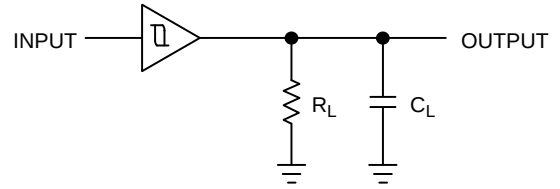


Figure 3. Switching Waveforms



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

Figure 4. Test Circuit

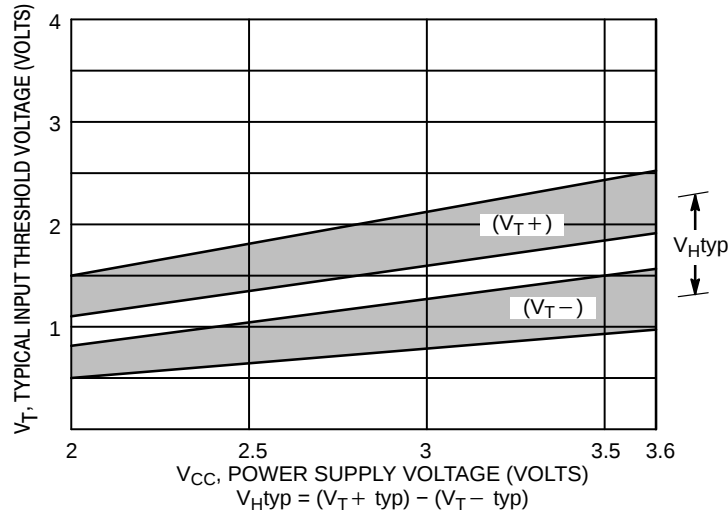
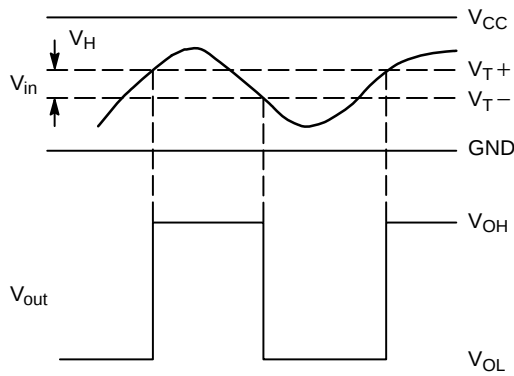
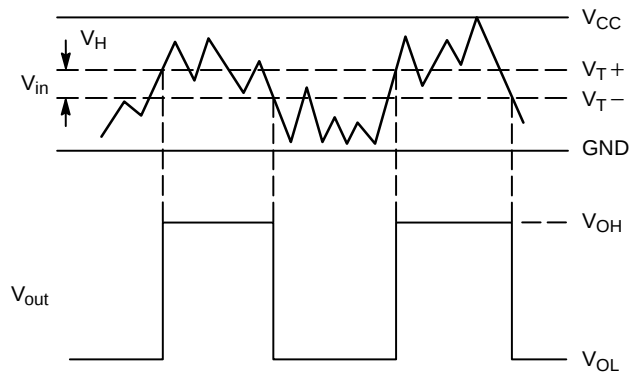


Figure 5. Typical Input Threshold,  $V_{T+}$ ,  $V_{T-}$  versus Power Supply Voltage



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



(b) A Schmitt-Trigger Offers Maximum Noise Immunity

Figure 6. Typical Schmitt-Trigger Applications

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## DEVICE ORDERING INFORMATION

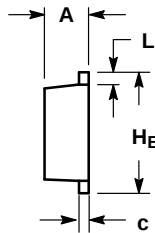
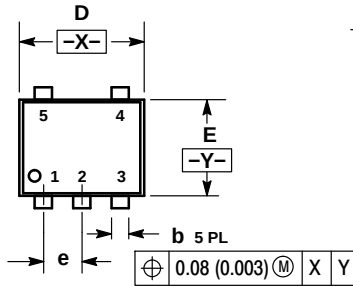
| Device Order Number | Package Type                     | Tape/Reel Size <sup>†</sup> |
|---------------------|----------------------------------|-----------------------------|
| NL17SZ17DFT2G       | SC-88A/SC-70-5/SOT-353 (Pb-Free) | 3000 Units / Tape & Reel    |
| NLV17SZ17DFT2G*     | SC-88A/SC-70-5/SOT-353 (Pb-Free) | 3000 Units / Tape & Reel    |
| NL17SZ17XV5T2G      | SOT-553 (Pb-Free)                | 4000 Units / Tape & Reel    |
| NL17SZ17XV5T2GH     | SOT-553 (Pb-Free)                | 4000 Units / Tape & Reel    |
| NL17SZ17P5T5G       | SOT-953 (Pb-Free)                | 8000 Units / Tape & Reel    |

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

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

## PACKAGE DIMENSIONS

### SOT-553 XV5 SUFFIX CASE 463B ISSUE B

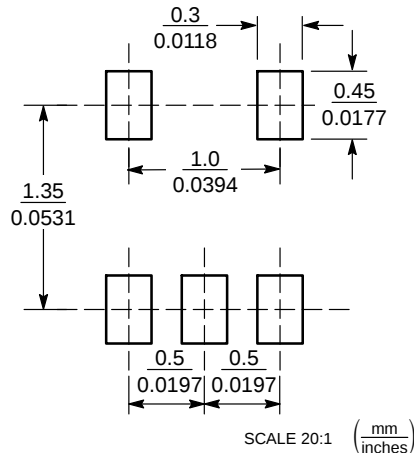


#### NOTES:

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   | 1.50        | 1.60 | 1.70 | 0.059     | 0.063 | 0.067 |
| E   | 1.10        | 1.20 | 1.30 | 0.043     | 0.047 | 0.051 |
| e   | 0.50 BSC    |      |      | 0.020 BSC |       |       |
| L   | 0.10        | 0.20 | 0.30 | 0.004     | 0.008 | 0.012 |
| HE  | 1.50        | 1.60 | 1.70 | 0.059     | 0.063 | 0.067 |

## SOLDERING FOOTPRINT\*



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

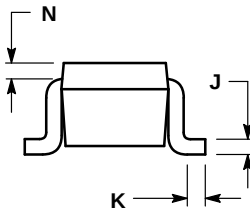
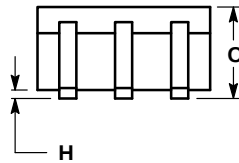
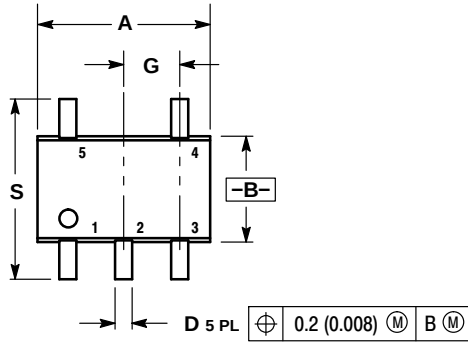
# NL17SZ17

## PACKAGE DIMENSIONS

### SC-88A (SC-70-5/SOT-353)

CASE 419A-02

ISSUE L

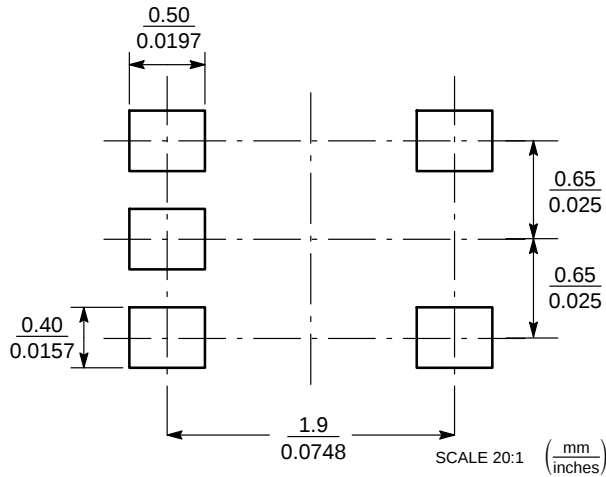


#### NOTES:

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 |

### SOLDERING FOOTPRINT\*

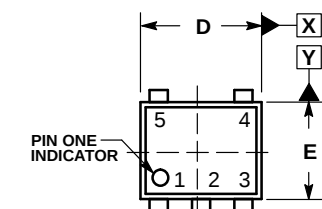


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

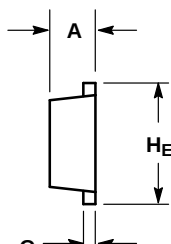
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## PACKAGE DIMENSIONS

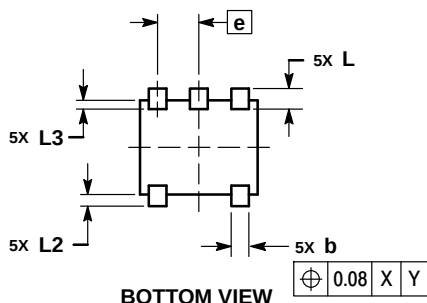
### SOT-953 CASE 527AE ISSUE E



TOP VIEW



SIDE VIEW



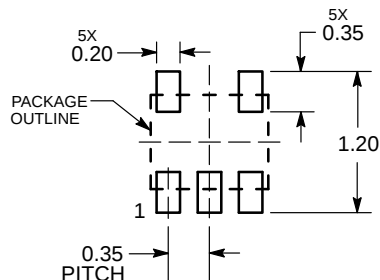
BOTTOM VIEW

#### 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 <sub>E</sub> | 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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