

# NL17SZU04

## Single Unbuffered Inverter

The NL17SZU04 is a single unbuffered inverter in two tiny footprint package. The device performs much as LCX multi-gate products in speed and drive.

- Tiny SOT-353 and SOT-553 Packages
- Source/Sink  $\pm 16$  mA at 4.5 V  $V_{CC}$
- Over-Voltage Tolerant Inputs and Outputs
- Pin For Pin with NC7SZU04P5X, TC7SZU04FU and TC7SZU04AFE
- Chip Complexity: FETs = 20
- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation

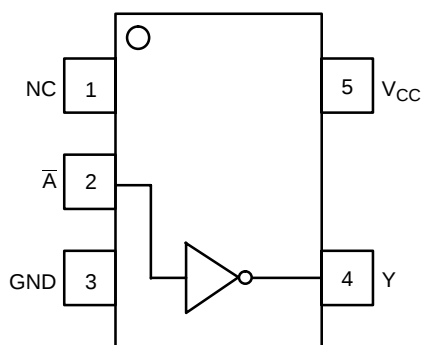


Figure 1. Pinout (Top View)

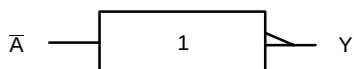


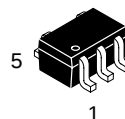
Figure 2. Logic Symbol



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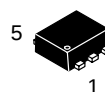
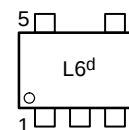
<http://onsemi.com>

### MARKING DIAGRAMS

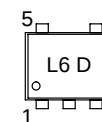


SOT-353/SC70-5/SC-88A  
DF SUFFIX  
CASE 419A

d = Date Code



SOT-553  
XV5 SUFFIX  
CASE 463B



L6 = Device Marking  
D = One Digit Date Code

### PIN ASSIGNMENT

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

### FUNCTION TABLE

| Input | Output<br>$Y = \bar{A}$ |
|-------|-------------------------|
| A     | Y                       |
| L     | H                       |
| H     | L                       |

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

## MAXIMUM RATINGS

| Symbol           | Parameter                                       | Value                                                                                                              | Unit |
|------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|------|
| V <sub>CC</sub>  | DC Supply Voltage                               | − 0.5 to + 7.0                                                                                                     | V    |
| V <sub>IN</sub>  | DC Input Voltage                                | − 0.5 to + 7.0                                                                                                     | V    |
| V <sub>OUT</sub> | DC Output Voltage                               | − 0.5 to + 7.0                                                                                                     | V    |
| I <sub>IK</sub>  | DC Input Diode Current                          | − 50                                                                                                               | mA   |
| I <sub>OK</sub>  | DC Output Diode Current                         | − 50                                                                                                               | mA   |
| I <sub>OUT</sub> | DC Output Sink Current                          | ± 50                                                                                                               | mA   |
| I <sub>CC</sub>  | DC Supply Current per Supply Pin                | ± 100                                                                                                              | mA   |
| T <sub>STG</sub> | Storage Temperature Range                       | − 65 to + 150                                                                                                      | °C   |
| T <sub>L</sub>   | Lead Temperature, 1 mm from Case for 10 Seconds | 260                                                                                                                | °C   |
| T <sub>J</sub>   | Junction Temperature Under Bias                 | + 150                                                                                                              | °C   |
| θ <sub>JA</sub>  | Thermal Resistance                              | SOT- 353 (Note 1)<br>SOT- 553<br>350<br>496                                                                        | °C/W |
| P <sub>D</sub>   | Power Dissipation in Still Air at 85°C          | SOT- 353<br>SOT- 553<br>186<br>135                                                                                 | mW   |
| MSL              | Moisture Sensitivity                            | Level 1                                                                                                            |      |
| F <sub>R</sub>   | Flammability Rating                             | Oxygen Index: 28 to 34<br>UL 94 V-0 @ 0.125 in                                                                     |      |
| V <sub>ESD</sub> | ESD Withstand Voltage                           | Human Body Model (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4)<br>Class IC<br>Class A<br>N/A | V    |

Maximum Ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum-rated conditions is not implied. Functional operation should be restricted to the Recommended Operating Conditions.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
2. Tested to EIA/JESD22-A114-A, rated to EIA/JESD22-A114-B.
3. Tested to EIA/JESD22-A115-A, rated to EIA/JESD22-A115-A.
4. Tested to JESD22-C101-A.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Parameter                                                                                      | Min         | Max        | Unit |
|---------------------------------|------------------------------------------------------------------------------------------------|-------------|------------|------|
| V <sub>CC</sub>                 | DC Supply Voltage<br>(Operating)<br>Data Retention Only                                        | 1.65<br>1.5 | 5.5<br>5.5 | V    |
| V <sub>IN</sub>                 | DC Input Voltage                                                                               | 0           | 5.5        | V    |
| V <sub>OUT</sub>                | DC Output Voltage                                                                              | 0           | 5.5        | V    |
| T <sub>A</sub>                  | Operating Temperature Range                                                                    | −40         | +85        | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise and Fall Time<br>V <sub>CC</sub> = 3.0 V ± 0.3 V<br>V <sub>CC</sub> = 5.0 V ± 0.5 V | 0<br>0      | 100<br>20  | ns/V |

# DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter                                                                         | Condition                                                                                                                                                                                     | V <sub>CC</sub><br>(V)                                 | T <sub>A</sub> = 25°C                                            |                                                            |                                                  | – 40°C ≤ T <sub>A</sub> ≤ 85°C                                   |                                                  | Unit |
|------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------|------|
|                  |                                                                                   |                                                                                                                                                                                               |                                                        | Min                                                              | Typ                                                        | Max                                              | Min                                                              | Max                                              |      |
| V <sub>IH</sub>  | High-Level Input Voltage                                                          |                                                                                                                                                                                               | 1.65 to 1.85                                           | 0.85 V <sub>CC</sub>                                             |                                                            |                                                  | 0.85 V <sub>CC</sub>                                             |                                                  | V    |
|                  |                                                                                   |                                                                                                                                                                                               | 2.3 to 5.5                                             | 0.8 V <sub>CC</sub>                                              |                                                            |                                                  | 0.8 V <sub>CC</sub>                                              |                                                  |      |
| V <sub>IL</sub>  | Low-Level Input Voltage                                                           |                                                                                                                                                                                               | 1.65 to 1.85                                           |                                                                  |                                                            | 0.15 V <sub>CC</sub>                             |                                                                  | 0.15 V <sub>CC</sub>                             | V    |
|                  |                                                                                   |                                                                                                                                                                                               | 2.3 to 5.5                                             |                                                                  |                                                            | 0.2 V <sub>CC</sub>                              |                                                                  | 0.2 V <sub>CC</sub>                              |      |
| V <sub>OH</sub>  | High-Level Output Voltage<br>V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> | I <sub>OH</sub> = -100 μA<br>I <sub>OH</sub> = -3 mA<br>I <sub>OH</sub> = -4 mA<br>I <sub>OH</sub> = -6 mA<br>I <sub>OH</sub> = -8 mA<br>I <sub>OH</sub> = -12 mA<br>I <sub>OH</sub> = -16 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>OH</sub>  | I <sub>OL</sub> = 100 μA<br>I <sub>OL</sub> = 3 mA<br>I <sub>OL</sub> = 4 mA<br>I <sub>OL</sub> = 6 mA<br>I <sub>OL</sub> = 8 mA<br>I <sub>OL</sub> = 12 mA<br>I <sub>OL</sub> = 16 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>0.20<br>0.22<br>0.28<br>0.38<br>0.42               | 0.1<br>0.24<br>0.3<br>0.4<br>0.4<br>0.55<br>0.55 |                                                                  | 0.1<br>0.24<br>0.3<br>0.4<br>0.4<br>0.55<br>0.55 | V    |
| I <sub>IN</sub>  | Input Leakage Current                                                             | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                                                                                                                      | 0 to 5.5                                               |                                                                  |                                                            | ±0.1                                             |                                                                  | ±1.0                                             | μA   |
| I <sub>OFF</sub> | Power Off- Output Leakage Current                                                 | V <sub>OUT</sub> = 5.5 V                                                                                                                                                                      | 0                                                      |                                                                  |                                                            | 1                                                |                                                                  | 10                                               | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current                                                          | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                                                                                                                      | 1.65 to 5.5                                            |                                                                  |                                                            | 1                                                |                                                                  | 10                                               | μA   |

# AC ELECTRICAL CHARACTERISTICS 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 |      | – 40°C ≤ T <sub>A</sub> ≤ 85°C |      | Unit |
|------------------|---------------------------------------|------------------------------------------------|------------------------|-----------------------|------|--------------------------------|------|------|
|                  |                                       |                                                |                        | Min                   | Max  | Min                            | Max  |      |
| t <sub>PLH</sub> | Propagation Delay<br>(Figure 3 and 4) | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF  | 1.8 ± 0.15             | 1.0                   | 11.7 | 1.0                            | 12.1 | ns   |
| t <sub>PHL</sub> |                                       | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF  | 2.5 ± 0.2              | 0.8                   | 6.2  | 0.8                            | 6.5  |      |
|                  |                                       | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF  | 3.3 ± 0.3              | 0.5                   | 4.5  | 0.5                            | 4.8  |      |
|                  |                                       | R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF |                        | 1.0                   | 6.0  | 1.0                            | 6.5  |      |
|                  |                                       | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF  | 5.0 ± 0.5              | 0.5                   | 3.9  | 0.5                            | 1.0  |      |
|                  |                                       | R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF |                        | 0.8                   | 5.0  | 0.8                            | 5.5  |      |

# CAPACITIVE CHARACTERISTICS

| Symbol          | Parameter                                 | Condition                                                                                                                                            | Typical   | Unit |
|-----------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|
| C <sub>IN</sub> | Input Capacitance                         | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>                                                                                     | 4.5       | pF   |
| C <sub>PD</sub> | Power Dissipation Capacitance<br>(Note 5) | 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> | 6.5<br>10 | pF   |

5. 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>.

# NL17SZU04

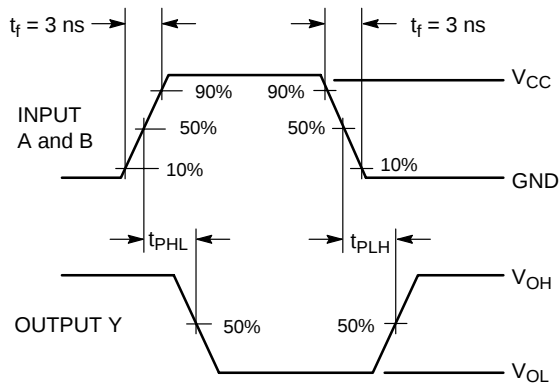
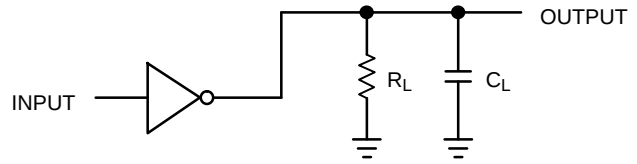


Figure 3. Switching Waveform



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

Figure 4. Test Circuit

## DEVICE ORDERING INFORMATION

| Device Order Number | Device Nomenclature     |                          |                       |            |                 |                |                      | Package Type                  | Tape and Reel Size   |
|---------------------|-------------------------|--------------------------|-----------------------|------------|-----------------|----------------|----------------------|-------------------------------|----------------------|
|                     | Logic Circuit Indicator | No. of Gates per Package | Temp Range Identifier | Technology | Device Function | Package Suffix | Tape and Reel Suffix |                               |                      |
| NL17SZU04DFT2       | NL                      | 1                        | 7                     | SZ         | U04             | DF             | T2                   | SOT-353/<br>SC70-5/<br>SC-88A | 178 mm,<br>3000 Unit |
| NL17SZU04XV5T2      | NL                      | 1                        | 7                     | SZ         | U04             | XV5            | T2                   | SOT-553                       | 178 mm,<br>4000 Unit |

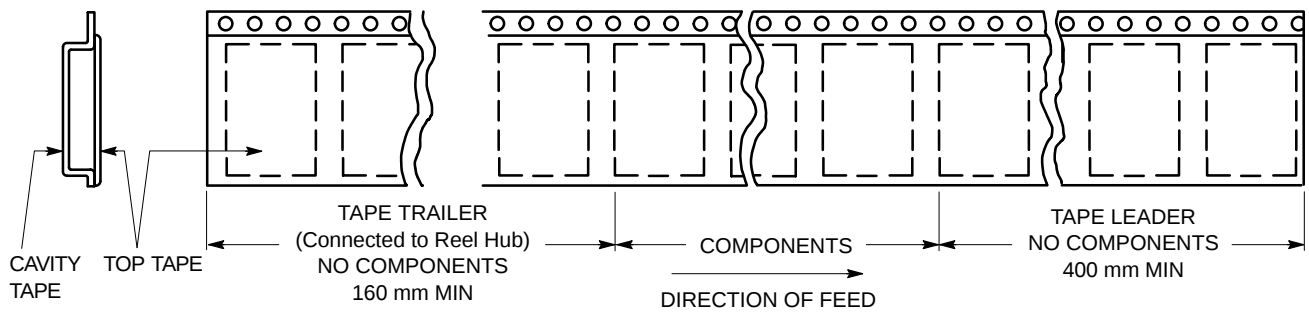
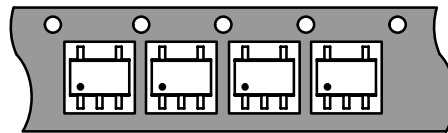
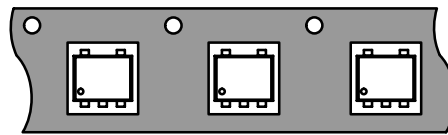


Figure 5. Tape Ends for Finished Goods



"T2" Pin One Opposing Sprocket Hole (3k Reel)

Figure 6. SOT-353/SC70-5/SC-88A Reel Configuration/Orientation



"T2" Pin One Opposing Sprocket Hole (4k Reel)

Figure 7. SOT-553 XV5T2 Reel Configuration/Orientation

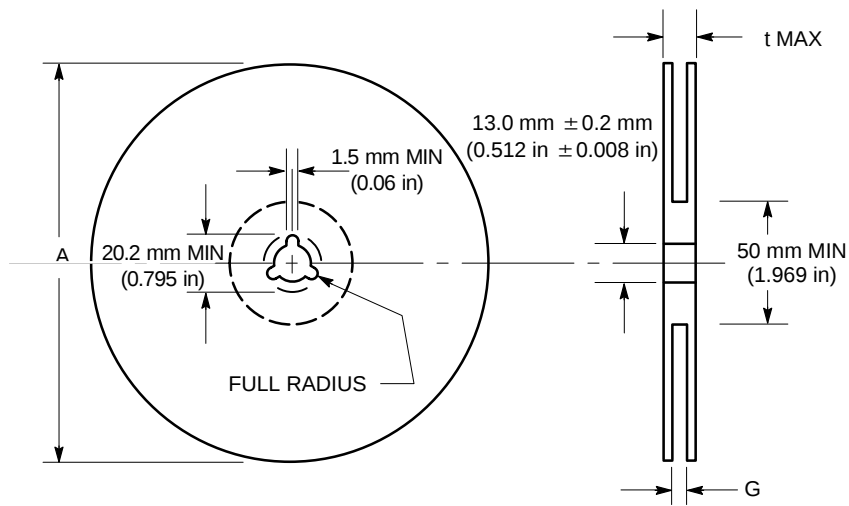


Figure 8. Reel Dimensions

**REEL DIMENSIONS†**

| Tape Size | T and R Suffix | A Max            | G                                                     | t Max                |
|-----------|----------------|------------------|-------------------------------------------------------|----------------------|
| 8 mm      | T2             | 178 mm<br>(7 in) | 8.4 mm, + 1.5 mm, -0.0<br>(0.33 in + 0.059 in, -0.00) | 14.4 mm<br>(0.56 in) |

†For additional tape and reel information, refer to Brochure BRD8011/D.

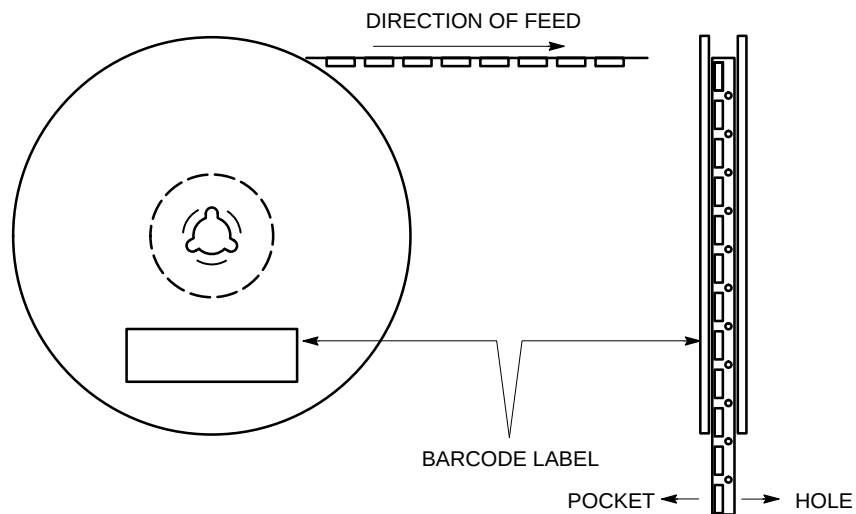
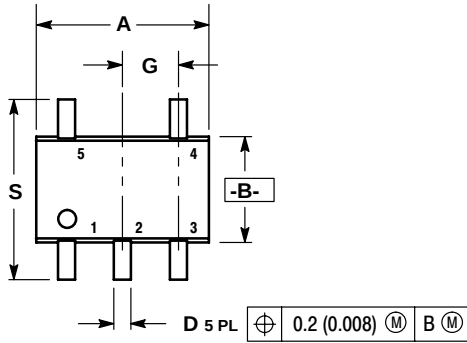


Figure 9. Reel Winding Direction

# NL17SZU04

## PACKAGE DIMENSIONS

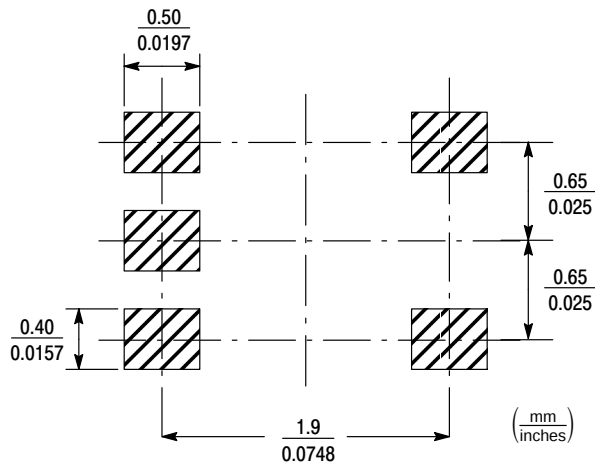
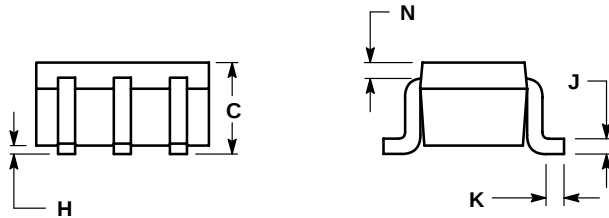
SOT-353  
DF SUFFIX  
5-LEAD PACKAGE  
CASE 419A-02  
ISSUE F



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.

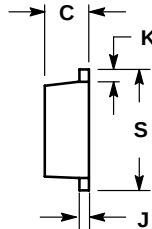
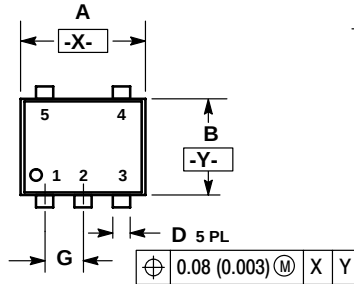
| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.071     | 0.087 | 1.80        | 2.20 |
| B   | 0.045     | 0.053 | 1.15        | 1.35 |
| C   | 0.031     | 0.043 | 0.80        | 1.10 |
| D   | 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 |



# NL17SZU04

## PACKAGE DIMENSIONS

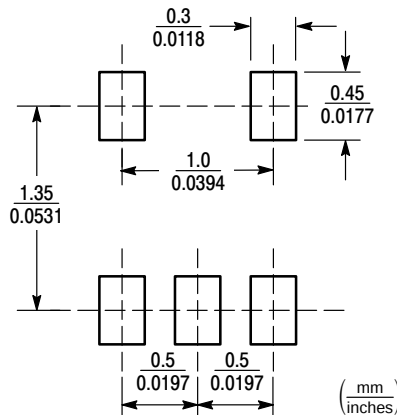
**SOT-553**  
**XV5 SUFFIX**  
**5-LEAD PACKAGE**  
**CASE 463B-01**  
**ISSUE O**



- 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         | MAX  | MIN       | MAX   |
| A   | 1.50        | 1.70 | 0.059     | 0.067 |
| B   | 1.10        | 1.30 | 0.043     | 0.051 |
| C   | 0.50        | 0.60 | 0.020     | 0.024 |
| D   | 0.17        | 0.27 | 0.007     | 0.011 |
| G   | 0.50 BSC    |      | 0.020 BSC |       |
| J   | 0.08        | 0.18 | 0.003     | 0.007 |
| K   | 0.10        | 0.30 | 0.004     | 0.012 |
| S   | 1.50        | 1.70 | 0.059     | 0.067 |

- STYLE 1:
- PIN 1. BASE 1
  - EMITTER 1/2
  - BASE 2
  - COLLECTOR 2
  - COLLECTOR 1
- STYLE 2:
- PIN 1. CATHODE
  - ANODE
  - CATHODE
  - CATHODE
  - CATHODE



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