

# NL17SZ14

## Single Inverter with Schmitt Trigger

The NL17SZ14 is a single inverter with Schmitt trigger in two tiny footprint packages. The device performs much as LCX multi-gate products in speed and drive.

### Features

- Tiny SOT-353 and SOT-553 Packages
- Source/Sink 24 mA at 3.0 V
- Over-Voltage Tolerant Inputs and Outputs
- Pin For Pin with NC7SZ14
- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation
- Chip Complexity: FET = 20
- Pb-Free Packages are Available

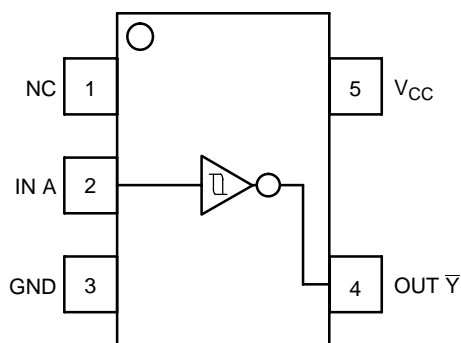


Figure 1. Pinout

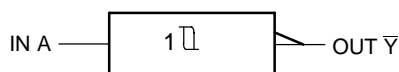


Figure 2. Logic Symbol



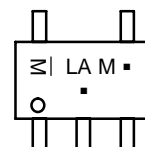
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### MARKING DIAGRAMS



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



SOT-553  
XV5 SUFFIX  
CASE 463B



LA = Device Code  
M = Date Code\*  
A = Assembly Location  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

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

### PIN ASSIGNMENT

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

| A Input | $\bar{Y}$ Output |
|---------|------------------|
| L       | H                |
| H       | L                |

### ORDERING INFORMATION

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

# NL17SZ14

## MAXIMUM RATINGS

| Symbol           | Characteristics                                                                                            | Value                        | Unit |
|------------------|------------------------------------------------------------------------------------------------------------|------------------------------|------|
| V <sub>CC</sub>  | DC Supply Voltage                                                                                          | -0.5 to +7.0                 | V    |
| V <sub>I</sub>   | DC Input Voltage                                                                                           | -0.5 ≤ V <sub>I</sub> ≤ +7.0 | V    |
| V <sub>O</sub>   | DC Output Voltage<br>Output in High or LOW State (Note 1)                                                  | -0.5 ≤ V <sub>O</sub> ≤ 7.0  | V    |
| I <sub>IK</sub>  | DC Input Diode Current<br>V <sub>I</sub> < GND                                                             | -50                          | mA   |
| I <sub>OK</sub>  | DC Output Diode Current<br>V <sub>O</sub> < GND                                                            | -50                          | mA   |
| I <sub>O</sub>   | DC Output Sink Current                                                                                     | ±50                          | mA   |
| I <sub>CC</sub>  | DC Supply Current per Supply Pin                                                                           | ±100                         | mA   |
| I <sub>GND</sub> | DC Ground Current per Ground Pin                                                                           | ±100                         | mA   |
| T <sub>STG</sub> | Storage Temperature Range                                                                                  | -65 to +150                  | °C   |
| P <sub>D</sub>   | Power Dissipation in Still Air<br>SOT-353<br>SOT-553                                                       | 186<br>135                   | mW   |
| θ <sub>JA</sub>  | Thermal Resistance<br>SOT-353<br>SOT-553                                                                   | 350<br>496                   | °C/W |
| 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   |
| MSL              | Moisture Sensitivity                                                                                       | Level 1                      |      |
| F <sub>R</sub>   | Flammability Rating<br>Oxygen Index: 28 to 34                                                              | UL 94 V-0 @ 0.125 in         |      |
| ESD              | ESD Classification<br>Human Body Model (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4) | Class 2<br>Class C<br>N/A    |      |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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> | Supply Voltage<br>Operating<br>Data Retention Only                                                                                          | 1.65<br>1.5 | 5.5<br>5.5                       | V    |
| V <sub>I</sub>  | Input Voltage                                                                                                                               | 0           | 5.5                              | V    |
| V <sub>O</sub>  | Output Voltage<br>(High or LOW State)                                                                                                       | 0           | 5.5                              | V    |
| T <sub>A</sub>  | Operating Free-Air Temperature                                                                                                              | -40         | +85                              | °C   |
| Δt/ΔV           | Input Transition Rise or Fall Rate<br>V <sub>CC</sub> = 2.5 V ± 0.2 V<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<br>0 | No Limit<br>No Limit<br>No Limit | ns/V |

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## 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>T+</sub>  | Positive Input Threshold Voltage                                                  |                                          | 1.65                   | 0.6                   | 1.0             | 1.4  | 0.6                           | 1.4  | V    |
|                  |                                                                                   |                                          | 2.3                    | 1.0                   | 1.5             | 1.8  | 1.0                           | 1.8  |      |
|                  |                                                                                   |                                          | 2.7                    | 1.2                   | 1.7             | 2.0  | 1.2                           | 2.0  |      |
|                  |                                                                                   |                                          | 3.0                    | 1.3                   | 1.9             | 2.2  | 1.3                           | 2.2  |      |
|                  |                                                                                   |                                          | 4.5                    | 1.9                   | 2.7             | 3.1  | 1.9                           | 3.1  |      |
|                  |                                                                                   |                                          | 5.5                    | 2.2                   | 3.3             | 3.6  | 2.2                           | 3.6  |      |
| V <sub>T-</sub>  | Negative Input Threshold Voltage                                                  |                                          | 1.65                   | 0.2                   | 0.5             | 0.8  | 0.2                           | 0.8  | V    |
|                  |                                                                                   |                                          | 2.3                    | 0.4                   | 0.75            | 1.15 | 0.4                           | 1.15 |      |
|                  |                                                                                   |                                          | 2.7                    | 0.5                   | 0.87            | 1.4  | 0.5                           | 1.4  |      |
|                  |                                                                                   |                                          | 3.0                    | 0.6                   | 1.0             | 1.5  | 0.6                           | 1.5  |      |
|                  |                                                                                   |                                          | 4.5                    | 1.0                   | 1.5             | 2.0  | 1.0                           | 2.0  |      |
|                  |                                                                                   |                                          | 5.5                    | 1.2                   | 1.9             | 2.3  | 1.2                           | 2.3  |      |
| V <sub>H</sub>   | Input Hysteresis Voltage                                                          |                                          | 1.65                   | 0.1                   | 0.48            | 0.9  | 0.1                           | 0.9  | V    |
|                  |                                                                                   |                                          | 2.3                    | 0.25                  | 0.75            | 1.1  | 0.25                          | 1.1  |      |
|                  |                                                                                   |                                          | 2.7                    | 0.3                   | 0.83            | 1.15 | 0.3                           | 1.15 |      |
|                  |                                                                                   |                                          | 3.0                    | 0.4                   | 0.93            | 1.2  | 0.4                           | 1.2  |      |
|                  |                                                                                   |                                          | 4.5                    | 0.6                   | 1.2             | 1.5  | 0.6                           | 1.5  |      |
|                  |                                                                                   |                                          | 5.5                    | 0.7                   | 1.4             | 1.7  | 0.7                           | 1.7  |      |
| 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                | 1.65 to 5.5            | V <sub>CC</sub> - 0.1 | V <sub>CC</sub> |      | V <sub>CC</sub> - 0.1         | V    |      |
|                  |                                                                                   | I <sub>OH</sub> = -3 mA                  | 1.65                   | 1.29                  | 1.52            |      | 1.29                          |      |      |
|                  |                                                                                   | I <sub>OH</sub> = -8 mA                  | 2.3                    | 1.9                   | 2.1             |      | 1.9                           |      |      |
|                  |                                                                                   | I <sub>OH</sub> = -12 mA                 | 2.7                    | 2.2                   | 2.4             |      | 2.2                           |      |      |
|                  |                                                                                   | I <sub>OH</sub> = -16 mA                 | 3.0                    | 2.4                   | 2.7             |      | 2.4                           |      |      |
|                  |                                                                                   | I <sub>OH</sub> = -24 mA                 | 3.0                    | 2.3                   | 2.5             |      | 2.3                           |      |      |
|                  |                                                                                   | I <sub>OH</sub> = -32 mA                 | 4.5                    | 3.8                   | 4.0             |      | 3.8                           |      |      |
| 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                 | 1.65 to 5.5            |                       | 0.0             | 0.1  |                               | 0.1  | V    |
|                  |                                                                                   | I <sub>OL</sub> = 4 mA                   | 1.65                   |                       | 0.08            | 0.24 |                               | 0.24 |      |
|                  |                                                                                   | I <sub>OL</sub> = 8 mA                   | 2.3                    |                       | 0.2             | 0.3  |                               | 0.3  |      |
|                  |                                                                                   | I <sub>OL</sub> = 12 mA                  | 2.7                    |                       | 0.22            | 0.4  |                               | 0.4  |      |
|                  |                                                                                   | I <sub>OL</sub> = 16 mA                  | 3.0                    |                       | 0.28            | 0.4  |                               | 0.4  |      |
|                  |                                                                                   | I <sub>OL</sub> = 24 mA                  | 3.0                    |                       | 0.38            | 0.55 |                               | 0.55 |      |
|                  |                                                                                   | I <sub>OL</sub> = 32 mA                  | 4.5                    |                       | 0.42            | 0.55 |                               | 0.55 |      |
| 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 | 5.5                    |                       |                 | 1    |                               | 10   | μA   |

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## AC ELECTRICAL CHARACTERISTICS $t_R = t_F = 3.0 \text{ ns}$

| 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                   | Typ | Max  | Min                           | Max  |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>(Figure 3 and 4) | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF  | 1.65                   | 2.0                   | 9.1 | 15   | 2.0                           | 15.6 | ns   |
|                                      |                                       |                                                | 1.8                    | 2.0                   | 7.6 | 12.5 | 2.0                           | 13   |      |
|                                      |                                       |                                                | 2.5 ± 0.2              | 1.0                   | 5.0 | 9.0  | 1.0                           | 9.5  |      |
|                                      |                                       |                                                | 3.3 ± 0.3              | 1.0                   | 3.7 | 6.3  | 1.0                           | 6.5  |      |
|                                      |                                       |                                                | 5.0 ± 0.5              | 0.5                   | 3.1 | 5.2  | 0.5                           | 5.5  |      |
|                                      |                                       |                                                | 3.3 ± 0.3              | 1.5                   | 4.4 | 7.2  | 1.5                           | 7.5  |      |
|                                      |                                       | R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF | 5.0 ± 0.5              | 0.8                   | 3.7 | 5.9  | 0.8                           | 6.2  |      |

## 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>                                                                                     | > 4.0    | 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> | 25<br>30 | 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:  $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$ . C<sub>PD</sub> is used to determine the no-load dynamic power consumption;  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

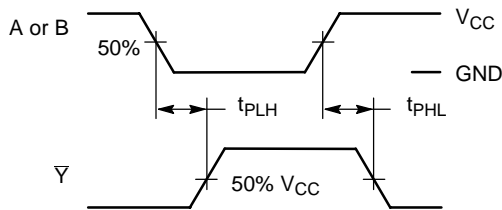
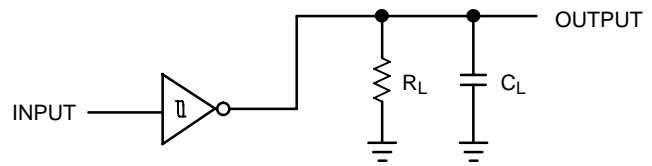


Figure 3. Switching Waveform



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

Figure 4. Test Circuit

## DEVICE ORDERING INFORMATION

| Device Order Number | Package Type                       | Tape and Reel Size† |
|---------------------|------------------------------------|---------------------|
| NL17SZ14DFT2        | SOT-353/SC70-5/SC-88A              | 3000 / Tape & Reel  |
| NL17SZ14DFT2G       | SOT-353/SC70-5/SC-88A<br>(Pb-Free) | 3000 / Tape & Reel  |
| NL17SZ14XV5T2       | SOT-553*                           | 3000 / Tape & Reel  |
| NL17SZ14XV5T2G      | SOT-553*                           | 3000 / Tape & Reel  |

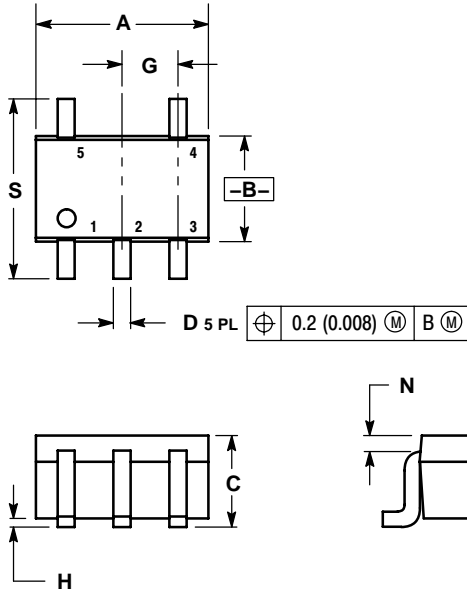
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*All Devices in Package SOT553 are Inherently Pb-Free.

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## PACKAGE DIMENSIONS

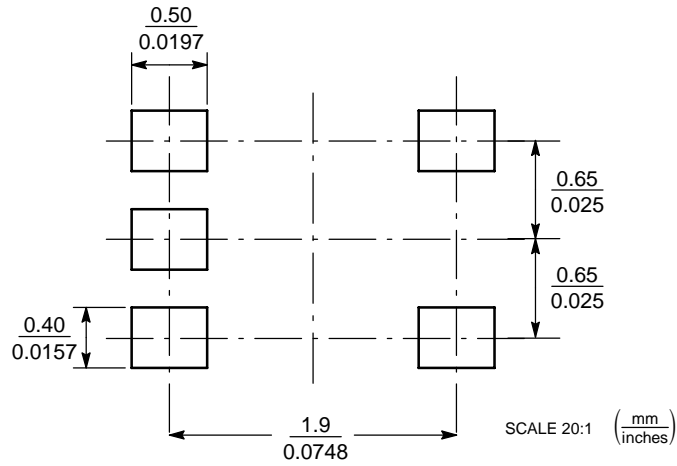
SC-88A, SOT-353, SC-70  
CASE 419A-02  
ISSUE J



- 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\*

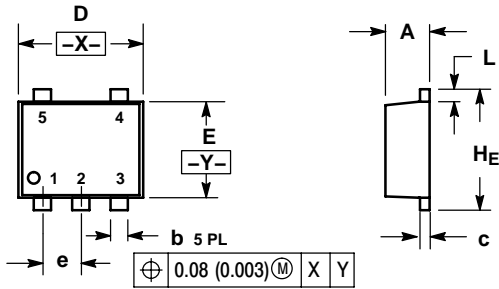


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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## PACKAGE DIMENSIONS

SOT-553, 5 LEAD  
CASE 463B-01  
ISSUE B

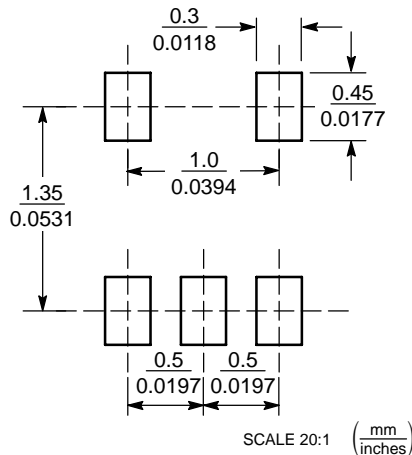


### NOTES:

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, SOLDERRM/D.

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