

NL17SZ16

Single Input Buffer

The NL17SZ16 is a single input Buffer 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 Volts
- Over-Voltage Tolerant Inputs and Outputs
- Chip Complexity: FETs = 20
- Designed for 1.65 V to 5.5 V V_{CC} Operation
- Pb-Free Packages are Available

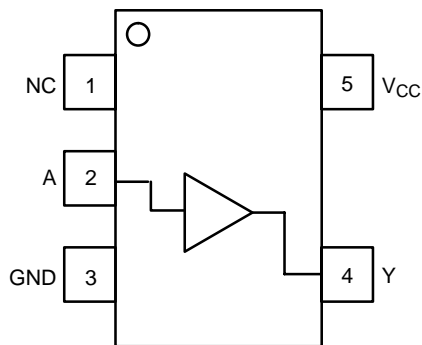


Figure 1. Pinout (Top View)

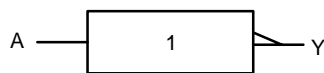
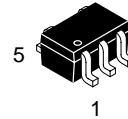


Figure 2. Logic Symbol



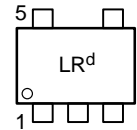
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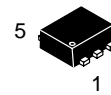


SOT-353/SC70-5/SC-88A
DF SUFFIX
CASE 419A

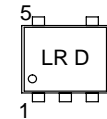
MARKING DIAGRAMS



d = Date Code



SOT-553
XV5 SUFFIX
CASE 463B



LR = Device Marking
D = One Digit Date Code

PIN ASSIGNMENT

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

FUNCTION TABLE

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

ORDERING INFORMATION

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

NL17SZ16

MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---------------|--|----------------------------|------|
| V_{CC} | DC Supply Voltage | -0.5 to +7.0 | V |
| V_I | DC Input Voltage Output in High or Low State (Note 2) | $-0.5 \leq V_I \leq +7.0$ | V |
| V_O | DC Output Voltage $V_I < \text{GND}$ | $-0.5 \leq V_O \leq +7.0$ | V |
| I_{IK} | DC Input Diode Current $V_O < \text{GND}$ | -50 | mA |
| I_{OK} | DC Output Diode Current | -50 | mA |
| I_{OUT} | DC Output Sink Current | ± 50 | mA |
| I_{CC} | DC Supply Current per Supply Pin | ± 100 | mA |
| I_{GND} | DC Ground per Supply Pin | ± 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 |
| θ_{JA} | Thermal Resistance SOT-353 SOT-553 | 350 360 | °C/W |
| P_D | Power Dissipation in Still Air at 85°C SOT-353 SOT-553 | 150 180 | mW |
| MSL | Moisture Sensitivity | Level 1 | |
| F_R | Flammability Rating Oxygen Index: 28 to 34 | UL 94 V-0 @ 0.125 in | |
| ESD | ESD Classification Human Body Model (Note 3) Machine Model (Note 4) Charged Device Model (Note 5) | Class IC Class A N/A | V |
| $I_{Latchup}$ | Latchup Performance Above V_{CC} and Below GND at 85°C (Note 6) | ± 500 | mA |

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. I_O Absolute Maximum Rating Must be Obtained.
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 JESD22-C101-A.
6. Tested to EIA/JESD78.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|------------|--|-------------|---------------|------|
| V_{CC} | DC Supply Voltage Operations Only Data Retention | 1.65 1.5 | 5.5 5.5 | V |
| V_{IN} | DC Input Voltage | 0 | 5.5 | V |
| V_{OUT} | DC Output Voltage | 0 | 5.5 | V |
| T_A | Operating Temperature Range | -40 | +85 | °C |
| t_r, t_f | Input Rise and Fall Time $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ $V_{CC} = 3.0 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$ | 0 0 0 | 20 10 5 | ns/V |

DEVICE JUNCTION TEMPERATURE VERSUS TIME TO 0.1% BOND FAILURES

| Junction Temperature °C | Time, Hours | Time, Years |
|-------------------------|-------------|-------------|
| 80 | 1,032,200 | 117.8 |
| 90 | 419,300 | 47.9 |
| 100 | 178,700 | 20.4 |
| 110 | 79,600 | 9.4 |
| 120 | 37,000 | 4.2 |
| 130 | 17,800 | 2.0 |
| 140 | 8,900 | 1.0 |

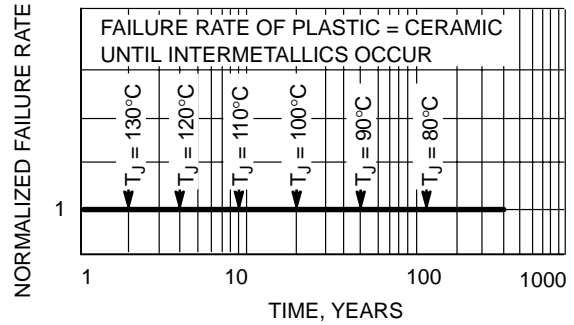


Figure 3. Failure Rate vs. Time Junction Temperature

DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Condition | V _{CC} (V) | T _A = 25°C | | | -40°C ≤ T _A ≤ 85°C | | Unit |
|------------------|---|---|--|--|--|--|--|--|------|
| | | | | Min | Typ | Max | Min | Max | |
| V _{IH} | High-Level Input Voltage | | 1.65 to 1.95 2.3 to 5.5 | 0.75 V _{CC} 0.7 V _{CC} | | | 0.75 V _{CC} 0.7 V _{CC} | | V |
| V _{IL} | Low-Level Input Voltage | | 1.65 to 1.95 2.3 to 5.5 | | | 0.25 V _{CC} 0.3 V _{CC} | | 1.25 V _{CC} 0.3 V _{CC} | V |
| V _{OH} | High-Level Output Voltage V _{IN} = V _{IL} or V _{IH} | I _{OH} = -100 μA I _{OH} = -3 mA I _{OH} = -8 mA I _{OH} = -12 mA I _{OH} = -16 mA I _{OH} = -24 mA I _{OH} = -32 mA | 1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5 | V _{CC} - 0.1 1.29 1.9 2.2 2.4 2.3 3.8 | V _{CC} 1.52 2.1 2.4 2.7 2.5 4.0 | | V _{CC} - 0.1 1.29 1.9 2.2 2.4 2.3 3.8 | | V |
| V _{OL} | Low-Level Output Voltage V _{IN} = V _{IH} or V _{OH} | I _{OL} = 100 μA I _{OL} = 4 mA I _{OL} = 8 mA I _{OL} = 12 mA I _{OL} = 16 mA I _{OL} = 24 mA I _{OL} = 32 mA | 1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5 | | 0.0 0.08 0.20 0.22 0.28 0.38 0.42 | 0.1 0.24 0.3 0.4 0.4 0.55 0.55 | | 0.1 0.24 0.3 0.4 0.4 0.55 0.55 | V |
| I _{IN} | Input Leakage Current | V _{IN} = V _{CC} or GND | 0 to 5.5 | | | ±0.1 | | ±1.0 | μA |
| I _{OFF} | Power Off-Output Leakage Current | V _{OUT} = 5.5 V | 0 | | | 1 | | 10 | μA |
| I _{CC} | Quiescent Supply Current | V _{IN} = V _{CC} or GND | 5.5 | | | 1 | | 10 | μA |

AC ELECTRICAL CHARACTERISTICS t_R = t_F = 3.0 ns

| Symbol | Parameter | Condition | V _{CC} (V) | T _A = 25°C | | | -40°C ≤ T _A ≤ 85°C | | Unit |
|--------------------------------------|---------------------------------------|--|--|---------------------------------|---------------------------------|----------------------------------|---------------------------------|-------------------------------|------|
| | | | | Min | Typ | Max | Min | Max | |
| t _{PLH} t _{PHL} | Propagation Delay (Figure 4 and 5) | R _L = 1 MΩ, C _L = 15 pF | 1.65 1.8 2.5 ± 0.2 3.3 ± 0.3 5.0 ± 0.5 | 2.0 2.0 0.8 0.5 0.5 | 5.3 4.4 2.9 2.1 1.8 | 11.4 9.5 6.5 4.5 3.9 | 2.0 2.0 0.8 0.5 0.5 | 12 10 7.0 4.7 4.1 | ns |
| | | R _L = 500 Ω, C _L = 50 pF | 3.3 ± 0.3 5.0 ± 0.5 | 1.5 0.8 | 2.9 2.4 | 5.0 4.3 | 1.5 0.8 | 5.2 4.5 | |

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CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Condition | Typical | Unit |
|----------|---|--|----------|------|
| C_{IN} | Input Capacitance | $V_{CC} = 5.5 \text{ V}, V_I = 0 \text{ V or } V_{CC}$ | > 4 | pF |
| C_{PD} | Power Dissipation Capacitance (Note 7) | 10 MHz, $V_{CC} = 3.3 \text{ V}, V_I = 0 \text{ V or } V_{CC}$ 10 MHz, $V_{CC} = 5.5 \text{ V}, V_I = 0 \text{ V or } V_{CC}$ | 25 30 | pF |

7. 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: $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$. C_{PD} is used to determine the no-load dynamic power consumption; $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.

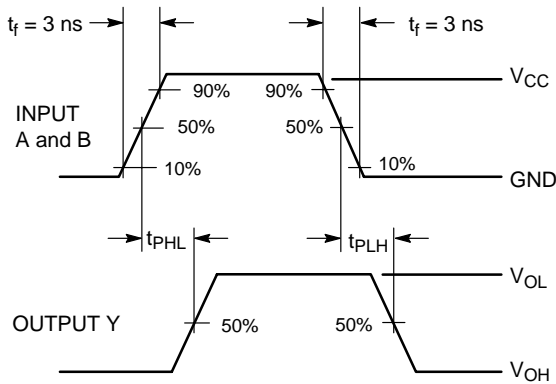
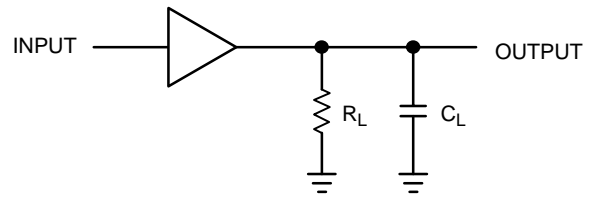


Figure 4. Switching Waveform



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

Figure 5. 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 | | |
| NL17SZ16DFT2 | NL | 1 | 7 | SZ | 16 | DF | T2 | SOT-353/ SC70-5/ SC-88A | 178 mm, 3000 Unit |
| NL17SZ16DFT2G | NL | 1 | 7 | SZ | 16 | DF | T2 | SOT-353/ SC70-5/ SC-88A (Pb-Free) | 178 mm, 3000 Unit |
| NL17SZ16XV5T2 | NL | 1 | 7 | SZ | 16 | XV5 | T2 | SOT-553* | 178 mm, 4000 Unit |

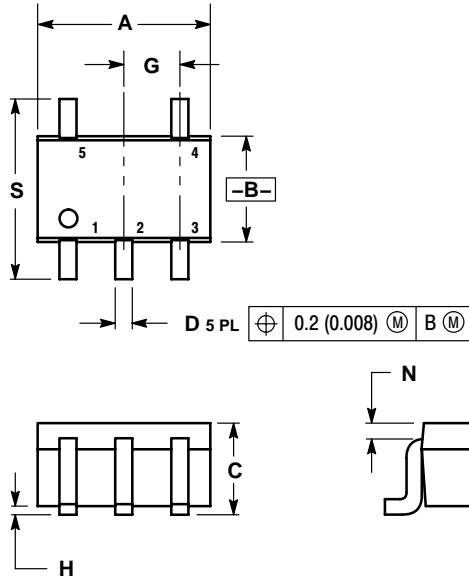
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

NL17SZ16

PACKAGE DIMENSIONS

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

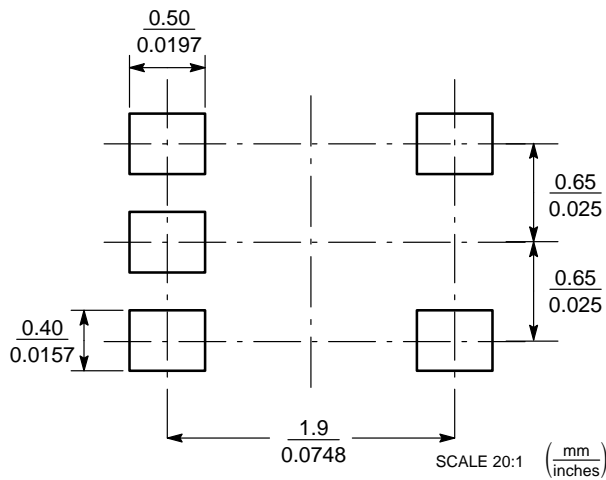


NOTES:

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*

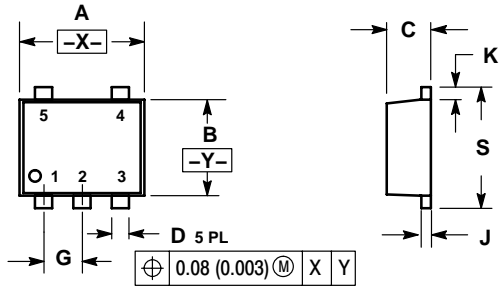


*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NL17SZ16

PACKAGE DIMENSIONS

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



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 |

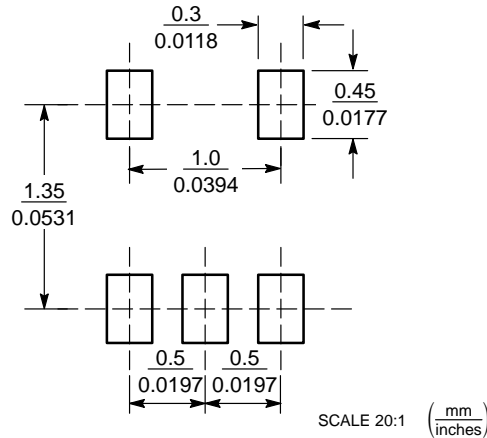
STYLE 1:

1. BASE 1
2. EMITTER 1/2
3. BASE 2
4. COLLECTOR 2
5. COLLECTOR 1

STYLE 2:

1. CATHODE
2. ANODE
3. CATHODE
4. CATHODE
5. CATHODE

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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