

NL17SZ07

Single Non-Inverting Buffer with Open Drain Output

The NL17SZ07 is a high performance single non-inverting buffer with open drain outputs operating from a 1.65 to 5.5 V supply.

The Output stage is open drain with Over Voltage Tolerance. This allows the NL17SZ07 to be used to interface 5.0 V circuits to circuits of any voltage between 0 and +7.0 V.

Features

- Tiny SOT-353, SOT-553 and SOT-953 Packages
- Extremely High Speed: t_{PD} 2.5 ns (typical) at $V_{CC} = 5$ V
- Designed for 1.65 V to 5.5 V V_{CC} Operation, CMOS Compatible
- Over Voltage Tolerant Inputs V_{IN} may be Between 0 and 7.0 V for V_{CC} Between 0.5 and 5.5 V
- TTL Compatible – Interface Capability with 5.0 V TTL Logic with $V_{CC} = 2.7$ V to 3.6 V
- LVCMOS Compatible
- 24 mA Output Sink Capability, Pullup may be between 0 and 7.0 V
- Near Zero Static Supply Current Substantially Reduces System Power Requirements
- Chip Complexity: FET = 20
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

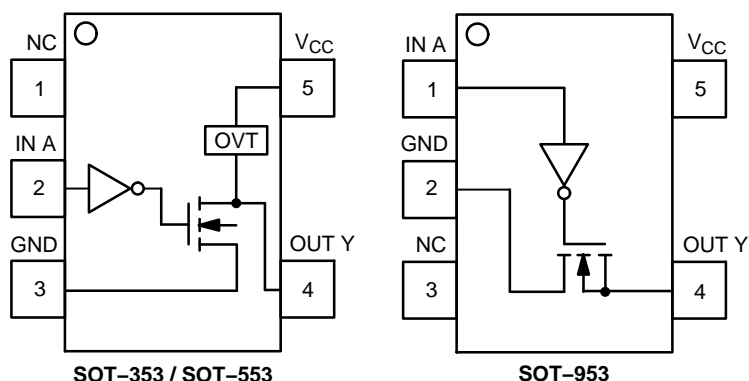


Figure 1. Pinout

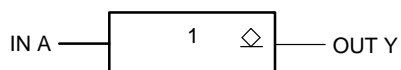


Figure 2. Logic Symbol

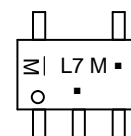


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MARKING DIAGRAMS


SC-88A / SOT-353 / SC-70
DF SUFFIX
CASE 419A



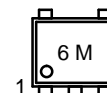

SOT-553
XV5 SUFFIX
CASE 463B



L7 = 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.


SOT-953
CASE 527AE



6 = Specific Device Code
M = Month Code

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

NL17SZ07

PIN ASSIGNMENT (SOT-353 / SOT-553)

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

PIN ASSIGNMENT (SOT-953)

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

FUNCTION TABLE

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

MAXIMUM RATINGS

| Symbol | Characteristics | Value | Unit |
|-----------------------|---|---|------|
| V _{CC} | DC Supply Voltage | −0.5 to +7.0 | V |
| V _I | DC Input Voltage | −0.5 ≤ V _I ≤ +7.0 | V |
| V _O | DC Output Voltage (SOT-953 Package) (Note 1) | −0.5 to V _{CC} + 0.5 | V |
| | DC Output Voltage (SOT-353 / SOT-553 Packages) Active Mode, LOW State (Note 1) Tri-State Mode Power-Down Mode (V _{CC} = 0 V) | −0.5 to V _{CC} + 0.5 −0.5 to +7.0 −0.5 to +7.0 | |
| I _{OK} | DC Output Diode Current (SOT-953 Package) V _O < GND, V _O > V _{CC} (SOT-353 / SOT-553 Packages) V _O < GND | ±50 −50 | mA |
| I _{IK} | DC Input Diode Current V _I < GND | −50 | mA |
| I _O | DC Output Sink Current | ±50 | mA |
| I _{CC} | DC Supply Current per Supply Pin | ±100 | mA |
| I _{GND} | DC Ground Current per Ground Pin | ±100 | mA |
| T _{STG} | Storage Temperature Range | −65 to +150 | °C |
| P _D | Power Dissipation in Still Air SOT-353 SOT-553 | 186 135 | mW |
| θ _{JA} | Thermal Resistance SOT-353 SOT-553 | 350 496 | °C/W |
| T _L | Lead Temperature, 1 mm from Case for 10 Seconds | 260 | °C |
| T _J | Junction Temperature Under Bias | +150 | °C |
| I _{Latch-Up} | Latch-Up Performance Above V _{CC} and Below GND at 85°C (Note 5) | ±100 | mA |
| 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) | 2000 | V |
| | | 200 | V |
| | | N/A | |

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. 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.
5. Tested to EIA/JESD78.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|---------------------|--|-------------|---------------|------|
| V_{CC} | Supply Voltage Operating Data Retention Only | 1.65 1.5 | 5.5 5.5 | V |
| V_I | Input Voltage | 0 | 5.5 | V |
| V_O | Output Voltage (SOT-953 Package) | 0 | V_{CC} | V |
| | Output Voltage (SOT-353 / SOT-553 Packages) | 0 | V_{CC} | |
| | Active Mode, LOW State | 0 | 5.5 | |
| | Tri-State Mode Power-Down Mode ($V_{CC} = 0$ V) | 0 0 | 5.5 5.5 | |
| T_A | Operating Free-Air Temperature | -55 | +125 | °C |
| $\Delta t/\Delta V$ | Input Transition Rise or Fall Rate $V_{CC} = 2.5$ V ± 0.2 V $V_{CC} = 3.0$ V ± 0.3 V $V_{CC} = 5.0$ V ± 0.5 V | 0 0 0 | 20 10 5 | 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.

DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Condition | V_{CC} (V) | $T_A = 25^\circ\text{C}$ | | | $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ | | 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} | | 0.25 V_{CC} 0.3 V_{CC} | V |
| I_{LKG} | Z-State Output Leakage Current | $V_{IN} = V_{IH}$ $V_{OUT} = V_{CC}$ or GND | 2.3 to 5.5 | | | ± 5.0 | | ± 10.0 | μA |
| V_{OL} | Low-Level Output Voltage $V_{IN} = V_{IL}$ | $I_{OL} = 100 \mu\text{A}$ | 1.65 to 5.5 | | 0.0 | 0.1 | | 0.1 | V |
| | | $I_{OL} = 4 \text{ mA}$ | 1.65 | | 0.08 | 0.24 | | 0.24 | |
| | | $I_{OL} = 8 \text{ mA}$ | 2.3 | | 0.20 | 0.3 | | 0.3 | |
| | | $I_{OL} = 12 \text{ mA}$ | 2.7 | | 0.22 | 0.4 | | 0.4 | |
| | | $I_{OL} = 16 \text{ mA}$ | 3.0 | | 0.28 | 0.4 | | 0.4 | |
| | | $I_{OL} = 24 \text{ mA}$ | 3.0 | | 0.38 | 0.55 | | 0.55 | |
| | | $I_{OL} = 32 \text{ mA}$ | 4.5 | | 0.42 | 0.55 | | 0.55 | |
| I_{IN} | Input Leakage Current | $V_{IN} = 5.5$ V or GND | 0 to 5.5 | | | ± 0.1 | | ± 1.0 | μA |
| I_{OFF} | Power Off Leakage Current (SOT-353/ SOT-553 Packages) | $V_{IN} = 5.5$ V or $V_{OUT} = 5.5$ V | 0 | | | 1 | | 10 | μA |
| I_{CC} | Quiescent Supply Current | $V_{IN} = 5.5$ V or GND | 5.5 | | | 1 | | 10 | μA |
| I_{CCT} | Quiescent Supply Current | $V_{IN} = 3.0$ V | 3.6 | | | 10 | | 100 | μA |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

AC ELECTRICAL CHARACTERISTICS $t_R = t_F = 2.5 \text{ ns}$; $C_L = 50 \text{ pF}$; $R_L = 500 \Omega$

| Symbol | Parameter | Condition | $V_{CC} \text{ (V)}$ | $T_A = 25^\circ\text{C}$ | | | $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ | | Unit |
|-----------|---------------------------------------|--|----------------------|--------------------------|-----|------|---|------|------|
| | | | | Min | Typ | Max | Min | Max | |
| t_{PZL} | Propagation Delay (Figure 3 and 4) | $R_L = R_1 = 500 \Omega$, $C_L = 50 \text{ pF}$ | 1.8 ± 0.15 | 0.8 | 5.3 | 11.6 | 0.8 | 12.0 | ns |
| | | | 2.5 ± 0.2 | 1.2 | 3.7 | 5.8 | 1.2 | 6.4 | |
| | | | 3.3 ± 0.3 | 0.8 | 2.9 | 4.4 | 0.8 | 4.8 | |
| | | | 5.0 ± 0.5 | 0.5 | 2.3 | 3.5 | 0.5 | 3.9 | |
| t_{PLZ} | Propagation Delay (Figure 3 and 4) | $R_L = R_1 = 500 \Omega$, $C_L = 50 \text{ pF}$ | 1.8 ± 0.15 | 0.8 | 5.3 | 11.6 | 0.8 | 1.20 | ns |
| | | | 2.5 ± 0.2 | 1.2 | 2.8 | 5.8 | 1.2 | 6.4 | |
| | | | 3.3 ± 0.3 | 0.8 | 2.1 | 4.4 | 0.8 | 4.8 | |
| | | | 5.0 ± 0.5 | 0.5 | 1.4 | 3.5 | 0.5 | 3.9 | |

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} | > 2.5 | pF |
| C_{OUT} | Output Capacitance | $V_{CC} = 5.5 \text{ V}$, $V_I = 0 \text{ V}$ or V_{CC} | 4.0 | pF |
| C_{PD} | Power Dissipation Capacitance (Note 6) | 10 MHz, $V_{CC} = 5.5 \text{ V}$, $V_I = 0 \text{ V}$ or V_{CC} | 4.0 | pF |

6. 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; $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.

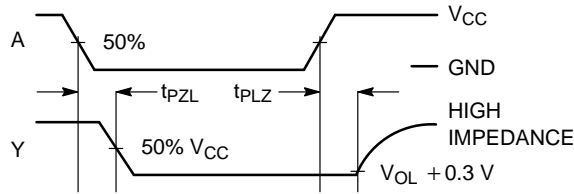


Figure 3. Switching Waveforms

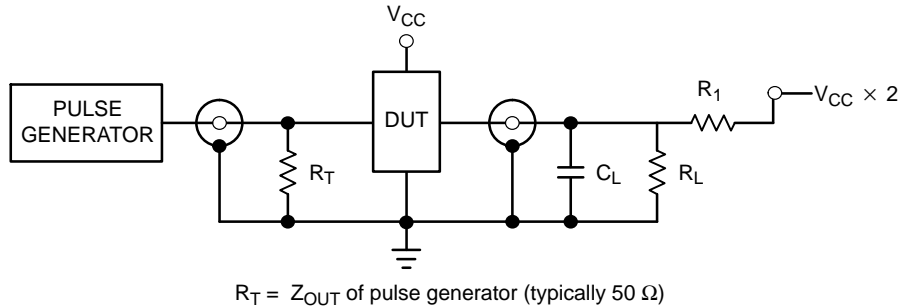


Figure 4. Test Circuit

NL17SZ07

DEVICE ORDERING INFORMATION

| Device | Package | Shipping [†] |
|----------------|------------------------------------|-----------------------|
| NL17SZ07DFT2G | SOT-353/SC70-5/SC-88A (Pb-Free) | 3000 / Tape & Reel |
| NL17SZ07XV5T2G | SOT-553 (Pb-Free) | 4000 / Tape & Reel |
| NL17SZ07P5T5G | SOT-953 (Pb-Free) | 8000 / 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.

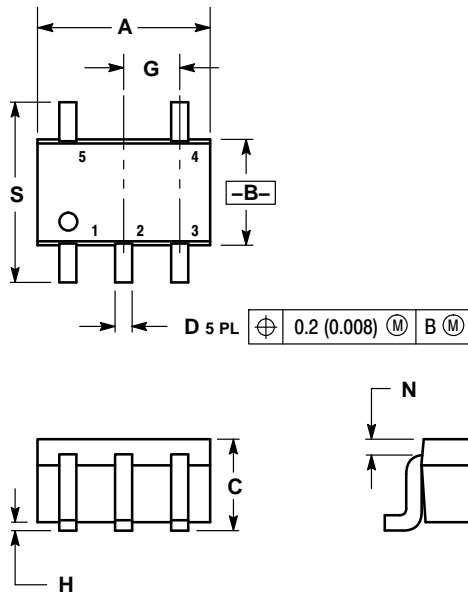
NL17SZ07

PACKAGE DIMENSIONS

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

CASE 419A-02

ISSUE L

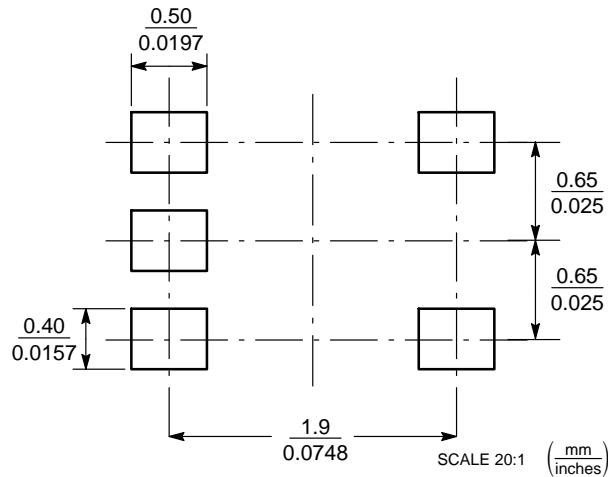


NOTES:

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

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

SOLDER FOOTPRINT*

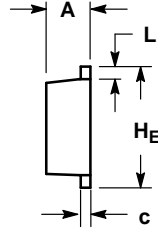
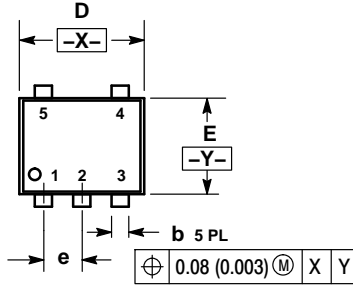


*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NL17SZ07

PACKAGE DIMENSIONS

SOT-553
XV5 SUFFIX
CASE 463B
ISSUE C

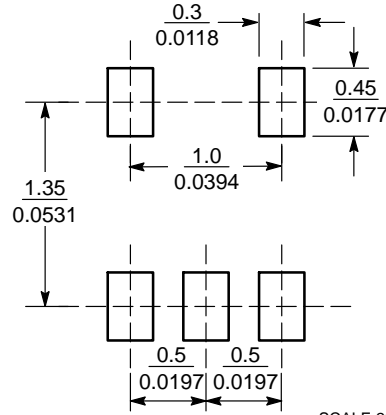


NOTES:

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

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

SOLDERING FOOTPRINT*



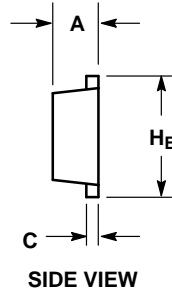
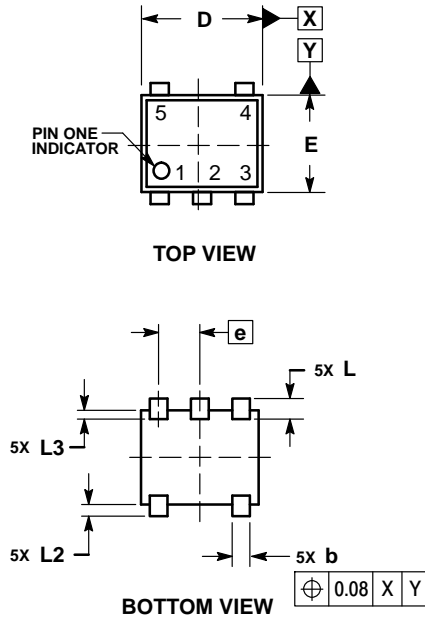
SCALE 20:1 (mm / inches)

*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

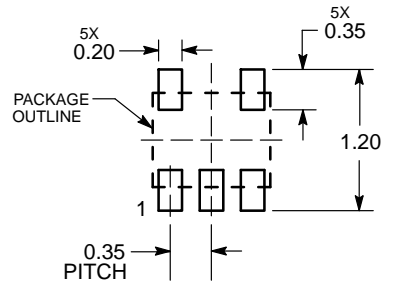


NOTES:

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


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

SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

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