# NL17SZ04

# Single Inverter

The NL17SZ04 is an inverter 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
- 24 mA Sink and Source Output Capability
- Over−Voltage Tolerant Inputs and Outputs
- Pin For Pin with NC7SZ04P5X, TC7SZ04FU and TC7SZ04AFE
- 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 and are RoHS Compliant

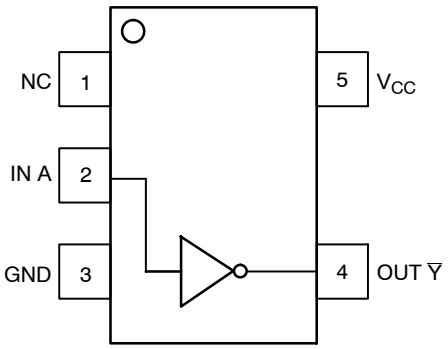


**Figure 1. Pinout** (Top View)

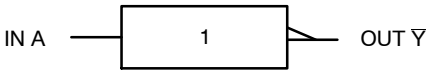


**Figure 2. Logic Symbol**

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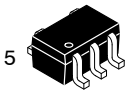
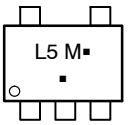
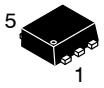



**SOT−353/SC70−5/SC−88A**
**DF SUFFIX**
**CASE 419A**

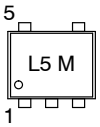
**MARKING DIAGRAMS**




L5 = Specific Device Marking
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−553**
**XV5 SUFFIX**
**CASE 463B**




L5 = Specific Device Marking
M = Date Code

**PIN ASSIGNMENT**

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

**FUNCTION TABLE**

| A Input | $\overline{Y}$ 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.

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## MAXIMUM RATINGS

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{CC}$ | DC Supply Voltage | | −0.5 to +7.0 | V |
| $V_I$ | DC Input Voltage | | $-0.5 \le V_I \le +7.0$ | V |
| $V_O$ | DC Output Voltage | Output in Higher or Low State (Note 1) | $-0.5 \le V_O \le +7.0$ | V |
| $I_{IK}$ | DC Input Diode Current | $V_I$ < GND | −50 | mA |
| $I_{OK}$ | DC Output Diode Current | $V_O$ < 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 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 |
| $\theta_{JA}$ | Thermal Resistance | SOT−353 (Note 2)<br>SOT−553 | 350<br>496 | °C/W |
| $P_D$ | Power Dissipation in Still Air at 85°C | SOT−353<br>SOT−553 | 186<br>135 | 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)<br>Machine Model (Note 4)<br>Charged Device Model (Note 5) | Class 2<br>Class C<br>N/A | |
| $I_{LATCHUP}$ | Latchup Performance Above $V_{CC}$ and Below GND at 125°C (Note 6) | | ±100 | mA |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. IO 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 JESD22−C101−A.
6. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | DC Supply Voltage | Operating<br>Data Retention | 1.65<br>1.5 | 5.5<br>5.5 | V |
| $V_{IN}$ | DC Input Voltage | | 0 | 5.5 | V |
| $V_{OUT}$ | DC Output Voltage | (High or Low State) | 0 | 5.5 | V |
| $T_A$ | Operating Temperature Range | | −55 | +125 | °C |
| $t_r$, $t_f$ | Input Rise and Fall Time | $V_{CC}$ = 2.5 V ± 0.2 V<br>$V_{CC}$ = 3.0 V ± 0.3 V<br>$V_{CC}$ = 5.0 V ± 0.5 V | 0<br>0<br>0 | 20<br>10<br>5 | ns/V |

## DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Condition | $V_{CC}$ (V) | $T_A$ = 25°C | | | −55°C ≤ $T_A$ ≤ 125°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | |
| $V_{IH}$ | High−Level Input Voltage | | 1.65 to 1.95<br>2.3 to 5.5 | 0.75 $V_{CC}$<br>0.7 $V_{CC}$ | | | 0.75 $V_{CC}$<br>0.7 $V_{CC}$ | | V |
| $V_{IL}$ | Low−Level Input Voltage | | 1.65 to 1.95<br>2.3 to 5.5 | | | 0.25 $V_{CC}$<br>0.3 $V_{CC}$ | | 0.25 $V_{CC}$<br>0.3 $V_{CC}$ | V |
| $V_{OH}$ | High−Level Output Voltage<br>$V_{IN}$ = $V_{IL}$ | $I_{OH}$ = −100 μA | 1.65 to 5.5 | $V_{CC}$ − 0.1 | $V_{CC}$ | | $V_{CC}$ − 0.1 | | V |
| | | $I_{OH}$ = −3 mA | 1.65 | 1.29 | 1.52 | | 1.29 | | |
| | | $I_{OH}$ = −8 mA | 2.3 | 1.9 | 2.1 | | 1.9 | | |
| | | $I_{OH}$ = −12 mA | 2.7 | 2.2 | 2.4 | | 2.2 | | |
| | | $I_{OH}$ = −16 mA | 3.0 | 2.4 | 2.7 | | 2.4 | | |
| | | $I_{OH}$ = −24 mA | 3.0 | 2.3 | 2.5 | | 2.3 | | |
| | | $I_{OH}$ = −32 mA | 4.5 | 3.8 | 4.0 | | 3.8 | | |
| $V_{OL}$ | Low−Level Output Voltage<br>$V_{IN}$ = $V_{IH}$ | $I_{OL}$ = 100 μA | 1.65 to 5.5 | | 0.0 | 0.1 | | 0.1 | V |
| | | $I_{OH}$ = 3 mA | 1.65 | | 0.08 | 0.24 | | 0.24 | |
| | | $I_{OL}$ = 8 mA | 2.3 | | 0.20 | 0.3 | | 0.3 | |
| | | $I_{OL}$ = 12 mA | 2.7 | | 0.22 | 0.4 | | 0.4 | |
| | | $I_{OL}$ = 16 mA | 3.0 | | 0.28 | 0.4 | | 0.4 | |
| | | $I_{OL}$ = 24 mA | 3.0 | | 0.38 | 0.55 | | 0.55 | |
| | | $I_{OL}$ = 32 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 | $V_{IN}$ = 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 |

## AC ELECTRICAL CHARACTERISTICS $t_R = t_F$ = 2.5 ns; $C_L$ = 50 pF; $R_L$ = 500 Ω

| Symbol | Parameter | Condition | $V_{CC}$ (V) | $T_A$ = 25°C | | | −55°C ≤ $T_A$ ≤ 125°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | |
| $t_{PLH}$<br>$t_{PHL7}$ | Propagation Delay<br>(Figure 3 and 4) | $R_L$ = 1 MΩ, $C_L$ = 15 pF | 1.65<br>1.8 | 2.0<br>2.0 | 5.3<br>4.4 | 11.4<br>9.5 | 2.0<br>2.0 | 12.0<br>10.0 | ns |
| | | $R_L$ = 1 MΩ, $C_L$ = 15 pF | 2.5 ± 0.2 | 0.2 | 3.5 | 6.5 | 0.8 | 7.0 | |
| | | $R_L$ = 1 MΩ, $C_L$ = 15 pF | 3.3 ± 0.3 | 0.8 | 2.1 | 4.5 | 0.5 | 4.7 | |
| | | $R_L$ = 500 Ω, $C_L$ = 50 pF | | 1.2 | 2.9 | 5.5 | 1.5 | 5.2 | |
| | | $R_L$ = 1 MΩ, $C_L$ = 15 pF | 5.0 ± 0.5 | 0.5 | 1.8 | 3.9 | 0.5 | 4.1 | |
| | | $R_L$ = 500 Ω, $C_L$ = 50 pF | | 0.8 | 2.4 | 4.3 | 0.8 | 4.5 | |

## CAPACITIVE CHARACTERISTICS

| Symbol | Parameter | Condition | Typical | Unit |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{CC}$ = 5.5 V, $V_I$ = 0 V or $V_{CC}$ | >2.5 | pF |
| $C_{PD}$ | Power Dissipation Capacitance (Note 7) | 10 MHz, $V_{CC}$ = 3.3 V, $V_I$ = 0 V or $V_{CC}$<br>10 MHz, $V_{CC}$ = 5.5 V, $V_I$ = 0 V or $V_{CC}$ | 9<br>11 | 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: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. $C_{PD}$ is used to determine the no−load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

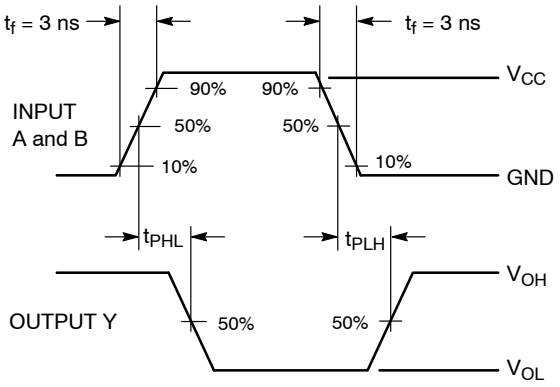
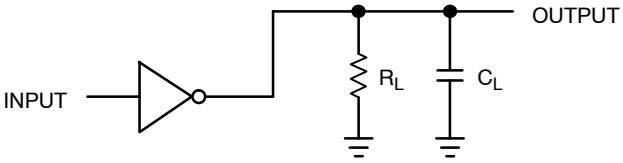



**Figure 3. Switching Waveform**




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

**Figure 4. Test Circuit**

**ORDERING INFORMATION**

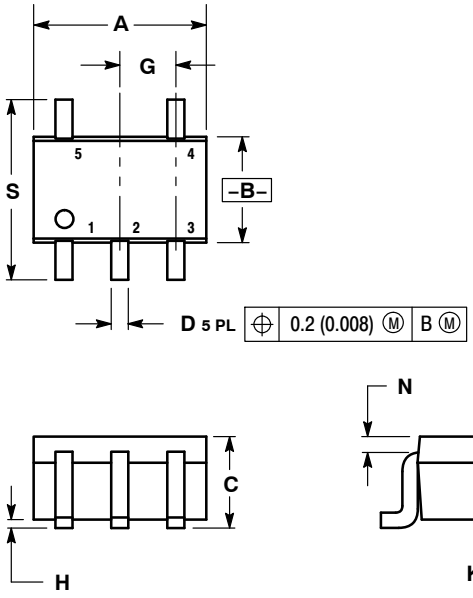
| Device | Package | Shipping† |
|---|---|---|
| NL17SZ04DFT2G | SC−88A/SOT−353/SC−70−5 (Pb−Free) | 3000 / Tape & Reel |
| NLV17SZ04DFT2G* | SC−88A/SOT−353/SC−70−5 (Pb−Free) | 3000 / Tape & Reel |
| NL17SZ04XV5T2G | SOT−553 (Pb−Free) | 4000 / Tape & Reel |

†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.

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

## PACKAGE DIMENSIONS

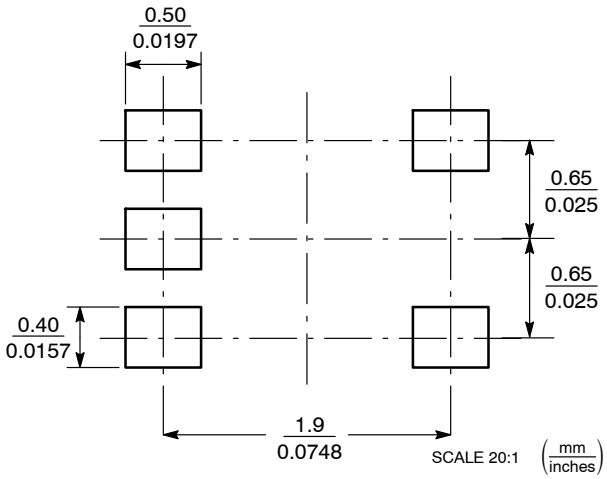
**SC−88A (SC−70−5/SOT−353)**
CASE 419A−02
ISSUE L




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.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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 |

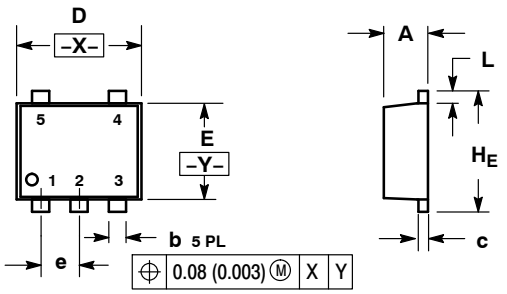
## SOLDER FOOTPRINT*




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

## PACKAGE DIMENSIONS

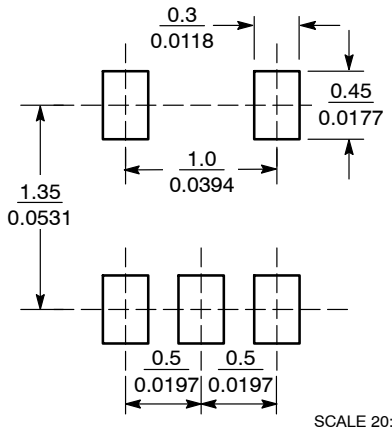
**SOT−553**
**XV5 SUFFIX**
CASE 463B
ISSUE B




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.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | 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 |
| $H_E$ | 1.50 | 1.60 | 1.70 | 0.059 | 0.063 | 0.067 |

## SOLDERING FOOTPRINT*




SCALE 20:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

*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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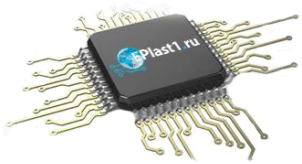
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

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