

NL27WZ04

Dual Inverter

The NL27WZ04 is a high performance dual inverter operating from a 1.65 V to 5.5 V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance.

Features

- Extremely High Speed: t_{PD} 2.0 ns (typical) at $V_{CC} = 5$ V
- Designed for 1.65 V to 5.5 V V_{CC} Operation
- Over Voltage Tolerant Inputs and Outputs
- LVTTTL Compatible – Interface Capability with 5 V TTL Logic with $V_{CC} = 3$ V
- LVC MOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current Substantially Reduces System Power Requirements
- Replacement for NC7W04
- Chip Complexity: FET = 72; Equivalent Gate = 18
- 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

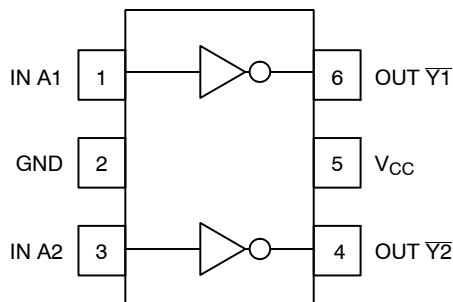


Figure 1. Pinout (Top View)

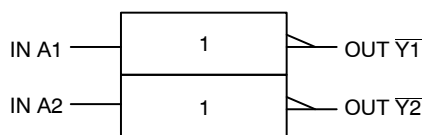


Figure 2. Logic Symbol



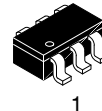
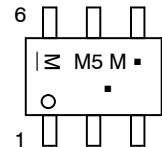
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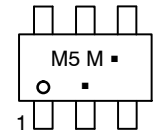
MARKING DIAGRAMS



SC-88
(SC70-6/SOT-363)
DF SUFFIX
CASE 419B



TSOP-6
DT SUFFIX
CASE 318G



M5 = Device Code
M = Date Code*
▪ = Pb-Free Package

(Note: Microdot may be in either location)

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

PIN ASSIGNMENT

| Pin | Function |
|-----|---------------------|
| 1 | IN A1 |
| 2 | GND |
| 3 | IN A2 |
| 4 | OUT $\overline{Y2}$ |
| 5 | V_{CC} |
| 6 | OUT $\overline{Y1}$ |

FUNCTION TABLE

| A Input | 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.

NL27WZ04

MAXIMUM RATINGS

| Symbol | Characteristics | Value | Units |
|---------------|---|---------------------------|-------|
| V_{CC} | DC Supply Voltage | -0.5 to +7.0 | V |
| V_I | DC Input Voltage | $-0.5 \leq V_I \leq +7.0$ | V |
| V_O | DC Output Voltage Output in HIGH or LOW State (Note 1) | $-0.5 \leq V_O \leq 7.0$ | V |
| I_{IK} | DC Input Diode Current $V_I < \text{GND}$ | -50 | mA |
| I_{OK} | DC Output Diode Current $V_O < \text{GND}$ | -50 | mA |
| I_O | DC Output Source/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 SC-88, TSOP-6 (Note 2) | 200 | mW |
| θ_{JA} | Thermal Resistance SC-88, TSOP-6 (Note 2) | 333 | °C/W |
| T_L | Lead Temperature, 1 mm from Case for 10 Seconds | 260 | °C |
| T_J | Junction Temperature Under Bias | +150 | °C |
| V_{ESD} | ESD Withstand Voltage Human Body Model (Note 3) Machine Model (Note 4) Charged Device Model (Note 5) | > 2000 > 200 N/A | V |
| $I_{LATCHUP}$ | 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. I_O 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
4. Tested to EIA/JESD22-A115-A
5. Tested to JESD22-C101-A
6. Tested to EIA/JESD78.

RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | Min | Max | Units |
|--|---------------------|-------------|---------------|-------|
| Supply Voltage Operating Data Retention Only | V_{CC} | 1.65 1.5 | 5.5 5.5 | V |
| Input Voltage | V_I | 0 | 5.5 | V |
| Output Voltage (HIGH or LOW State) | V_O | 0 | 5.5 | V |
| Operating Free-Air Temperature | T_A | -55 | +125 | °C |
| Input Transition Rise or Fall Rate $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ $V_{CC} = 3.0 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$ | $\Delta t/\Delta V$ | 0 0 0 | 20 10 5 | ns/V |

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DC ELECTRICAL CHARACTERISTICS

| Parameter | Condition | Symbol | V _{CC} (V) | T _A = 25°C | | | -55°C ≤ T _A ≤ 125°C | | Units |
|--|---|------------------|------------------------|-----------------------|-----------------|----------------------|--------------------------------|----------------------|-------|
| | | | | Min | Typ | Max | Min | Max | |
| High-Level Input Voltage | | V _{IH} | 1.65-1.95 | 0.75 V _{CC} | | | 0.75 V _{CC} | | V |
| | | | 2.3 to 5.5 | 0.7 V _{CC} | | | 0.7 V _{CC} | | |
| Low-Level Input Voltage | | V _{IL} | 1.65-1.95 | | | 0.25 V _{CC} | | 0.25 V _{CC} | V |
| | | | 2.3 to 5.5 | | | 0.3 V _{CC} | | 0.3 V _{CC} | |
| High-Level Output Voltage V _{IN} = V _{IL} | I _{OH} = -100 μA | V _{OH} | 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 | | |
| Low-Level Output Voltage V _{IN} = V _{IH} | I _{OL} = 100 μA | V _{OL} | 1.65 to 5.5 | | | 0.1 | | 0.1 | V |
| | I _{OL} = 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 | |
| Input Leakage Current | V _{IN} = 5.5 V or GND | I _{IN} | 0 to 5.5 | | | ±0.1 | | ±1.0 | μA |
| Power Off Leakage Current | V _{IN} = 5.5 V or V _{OUT} = 5.5 V | I _{OFF} | 0 | | | 1 | | 10 | μA |
| Quiescent Supply Current | V _{IN} = 5.5 V or GND | I _{CC} | 5.5 | | | 1 | | 10 | μA |

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

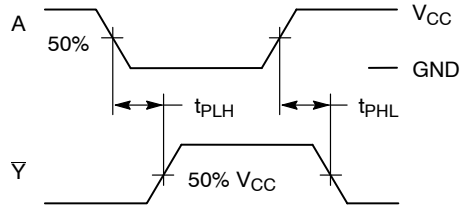
| Parameter | Condition | Symbol | V _{CC} (V) | T _A = 25°C | | | -55°C ≤ T _A ≤ 125°C | | Units |
|---------------------------------------|--|--------------------------------------|------------------------|-----------------------|-----|-----|--------------------------------|------|-------|
| | | | | Min | Typ | Max | Min | Max | |
| Propagation Delay (Figure 3 and 4) | R _L = 1 MΩ, C _L = 15 pF | t _{PLH} t _{PHL} | 1.65 | 1.8 | 2.3 | 9.2 | 1.8 | 11.0 | ns |
| | R _L = 1 MΩ, C _L = 15 pF | | 1.8 | 1.8 | 4.4 | 7.6 | 1.8 | 8.4 | |
| | R _L = 1 MΩ, C _L = 15 pF | | 2.5 ± 0.2 | 1.2 | 3.0 | 5.1 | 1.2 | 5.6 | |
| | R _L = 1 MΩ, C _L = 15 pF | | 3.3 ± 0.3 | 0.8 | 2.2 | 3.4 | 0.8 | 3.8 | |
| | R _L = 500 Ω, C _L = 50 pF | | | 1.2 | 2.9 | 4.5 | 1.2 | 5.0 | |
| | R _L = 1 MΩ, C _L = 15 pF | | 5.0 ± 0.5 | 0.5 | 1.8 | 2.8 | 0.5 | 3.1 | |
| | R _L = 500 Ω, C _L = 50 pF | | | 0.8 | 2.3 | 3.6 | 0.8 | 4.0 | |

CAPACITIVE CHARACTERISTICS

| Parameter | Symbol | Condition | Typical | Units |
|--|-----------------|--|---------|-------|
| Input Capacitance | C _{IN} | V _{CC} = 5.5 V, V _I = 0 V or V _{CC} | 2.5 | pF |
| Power Dissipation Capacitance (Note 7) | C _{PD} | 10 MHz, V _{CC} = 3.3 V, V _I = 0 V or V _{CC} | 9 | pF |
| | | 10 MHz, V _{CC} = 5.5 V, V _I = 0 V or V _{CC} | 11 | |

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} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

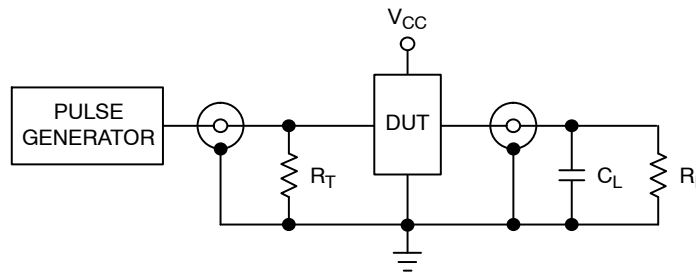
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PROPAGATION DELAYS

$t_R = t_F = 2.5 \text{ ns}$, 10% to 90%; $f = 1 \text{ MHz}$; $t_W = 500 \text{ ns}$

Figure 3. Switching Waveforms



$R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

Figure 4. Test Circuit

ORDERING INFORMATION

| Device | Package | Shipping† |
|-----------------|-----------------------------------|--------------------|
| NL27WZ04DFT1G | SC-88/SC70-6/SOT-363 (Pb-Free) | 3000 / Tape & Reel |
| NL27WZ04DFT2G | SC-88/SC70-6/SOT-363 (Pb-Free) | 3000 / Tape & Reel |
| NLV27WZ04DFT1G* | SC-88/SC70-6/SOT-363 (Pb-Free) | 3000 / Tape & Reel |
| NLV27WZ04DFT2G* | SC-88/SC70-6/SOT-363 (Pb-Free) | 3000 / Tape & Reel |
| NL27WZ04DTT1G | TSOP-6 (Pb-Free) | 3000 / Tape & Reel |

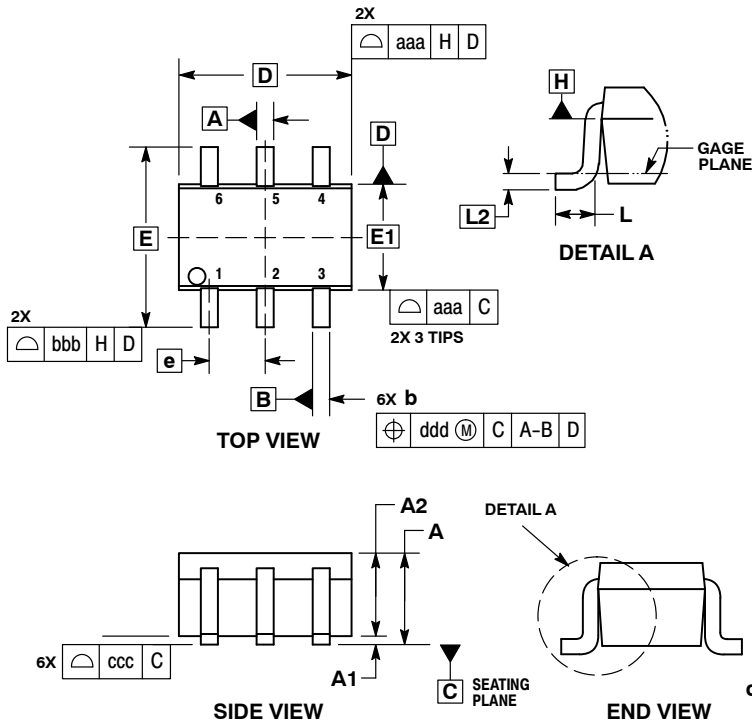
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

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PACKAGE DIMENSIONS

SC-88/SC70-6/SOT-363
CASE 419B-02
ISSUE Y

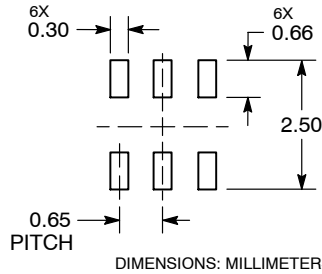


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|------|------|-----------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | --- | --- | 1.10 | --- | --- | 0.043 |
| A1 | 0.00 | --- | 0.10 | 0.000 | --- | 0.004 |
| A2 | 0.70 | 0.90 | 1.00 | 0.027 | 0.035 | 0.039 |
| b | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| C | 0.08 | 0.15 | 0.22 | 0.003 | 0.006 | 0.009 |
| D | 1.80 | 2.00 | 2.20 | 0.070 | 0.078 | 0.086 |
| E | 2.00 | 2.10 | 2.20 | 0.078 | 0.082 | 0.086 |
| E1 | 1.15 | 1.25 | 1.35 | 0.045 | 0.049 | 0.053 |
| e | 0.65 BSC | | | 0.026 BSC | | |
| L | 0.26 | 0.36 | 0.46 | 0.010 | 0.014 | 0.018 |
| L2 | 0.15 BSC | | | 0.006 BSC | | |
| aaa | 0.15 | | | 0.006 | | |
| bbb | 0.30 | | | 0.012 | | |
| ccc | 0.10 | | | 0.004 | | |
| ddd | 0.10 | | | 0.004 | | |

RECOMMENDED SOLDERING FOOTPRINT*



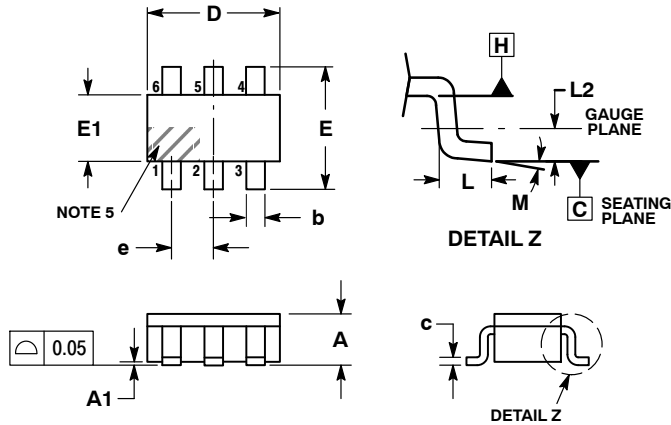
DIMENSIONS: MILLIMETERS

*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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PACKAGE DIMENSIONS

TSOP-6 CASE 318G-02 ISSUE V

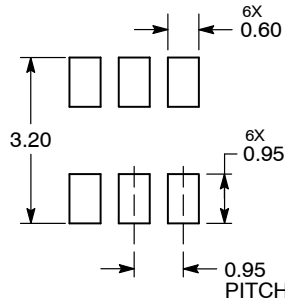


NOTES:

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 BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
5. PIN ONE INDICATOR MUST BE LOCATED IN THE INDICATED ZONE.

| DIM | MILLIMETERS | | |
|-----|-------------|------|------|
| | MIN | NOM | MAX |
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0.01 | 0.06 | 0.10 |
| b | 0.25 | 0.38 | 0.50 |
| c | 0.10 | 0.18 | 0.26 |
| D | 2.90 | 3.00 | 3.10 |
| E | 2.50 | 2.75 | 3.00 |
| E1 | 1.30 | 1.50 | 1.70 |
| e | 0.85 | 0.95 | 1.05 |
| L | 0.20 | 0.40 | 0.60 |
| L2 | 0.25 BSC | | |
| M | 0° | - | 10° |

RECOMMENDED 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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