

# 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
- LVCMOS 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

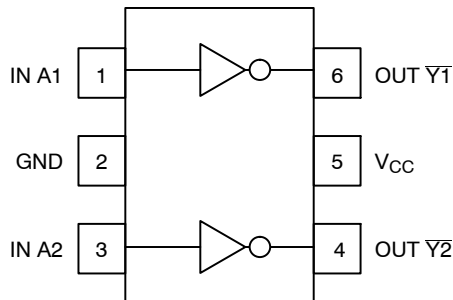


Figure 1. Pinout (Top View)

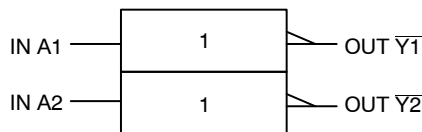


Figure 2. Logic Symbol



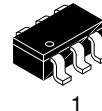
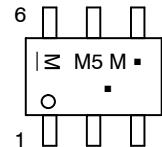
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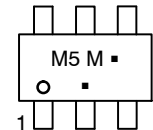
### MARKING DIAGRAMS



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 $\bar{Y}2$
5	$V_{CC}$
6	OUT $\bar{Y}1$

### 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	$\pm 50$	mA
$I_{CC}$	DC Supply Current Per Supply Pin	$\pm 100$	mA
$I_{GND}$	DC Ground Current Per Ground Pin	$\pm 100$	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
$\theta_{JA}$	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)	$\pm 100$	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 <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			-55°C ≤ T <sub>A</sub> ≤ 125°C		Units
				Min	Typ	Max	Min	Max	
High-Level Input Voltage		V <sub>IH</sub>	1.65-1.95	0.75 V <sub>CC</sub>			0.75 V <sub>CC</sub>		V
			2.3 to 5.5	0.7 V <sub>CC</sub>			0.7 V <sub>CC</sub>		
Low-Level Input Voltage		V <sub>IL</sub>	1.65-1.95			0.25 V <sub>CC</sub>		0.25 V <sub>CC</sub>	V
			2.3 to 5.5			0.3 V <sub>CC</sub>		0.3 V <sub>CC</sub>	
High-Level Output Voltage V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -100 μA	V <sub>OH</sub>	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		
Low-Level Output Voltage V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 100 μA	V <sub>OL</sub>	1.65 to 5.5			0.1		0.1	V
	I <sub>OL</sub> = 3 mA		1.65		0.08	0.24		0.24	
	I <sub>OL</sub> = 8 mA		2.3		0.20	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	
Input Leakage Current	V <sub>IN</sub> = 5.5 V or GND	I <sub>IN</sub>	0 to 5.5			±0.1		±1.0	μA
Power Off Leakage Current	V <sub>IN</sub> = 5.5 V or V <sub>OUT</sub> = 5.5 V	I <sub>OFF</sub>	0			1		10	μA
Quiescent Supply Current	V <sub>IN</sub> = 5.5 V or GND	I <sub>CC</sub>	5.5			1		10	μA

## AC ELECTRICAL CHARACTERISTICS t<sub>R</sub> = t<sub>F</sub> = 2.5 ns; C<sub>L</sub> = 50 pF; R<sub>L</sub> = 500 Ω

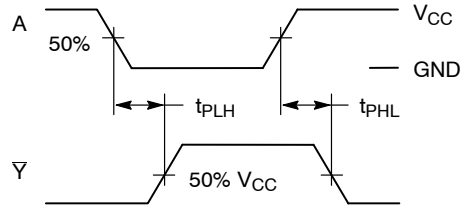
Parameter	Condition	Symbol	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			-55°C ≤ T <sub>A</sub> ≤ 125°C		Units
				Min	Typ	Max	Min	Max	
Propagation Delay (Figure 3 and 4)	R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF	t <sub>PLH</sub> t <sub>PHL</sub>	1.65	1.8	2.3	9.2	1.8	11.0	ns
	R <sub>L</sub> = 1 MΩ,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

## CAPACITIVE CHARACTERISTICS

Parameter	Symbol	Condition	Typical	Units
Input Capacitance	C <sub>IN</sub>	V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>	2.5	pF
Power Dissipation Capacitance (Note 7)	C <sub>PD</sub>	10 MHz, V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>	9	pF
		10 MHz, V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>	11	

7. 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<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

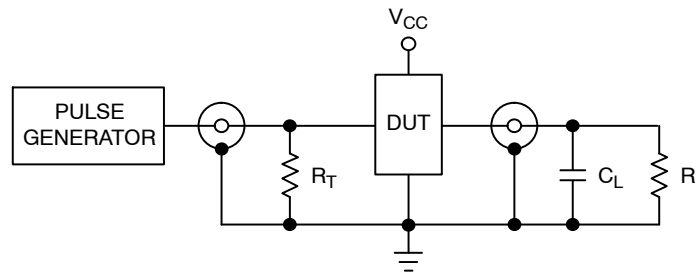
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### PROPAGATION DELAYS

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

**Figure 3. Switching Waveforms**



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

**Figure 4. Test Circuit**

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
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

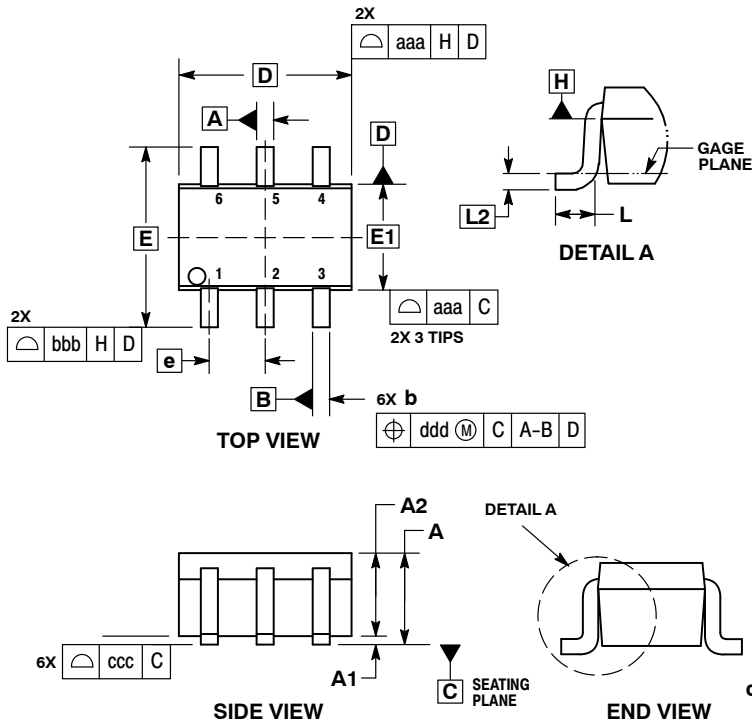
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*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

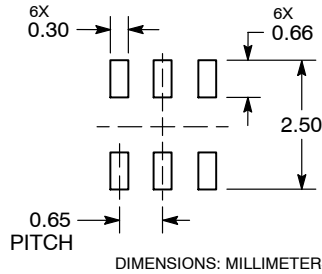


**NOTES:**

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\*

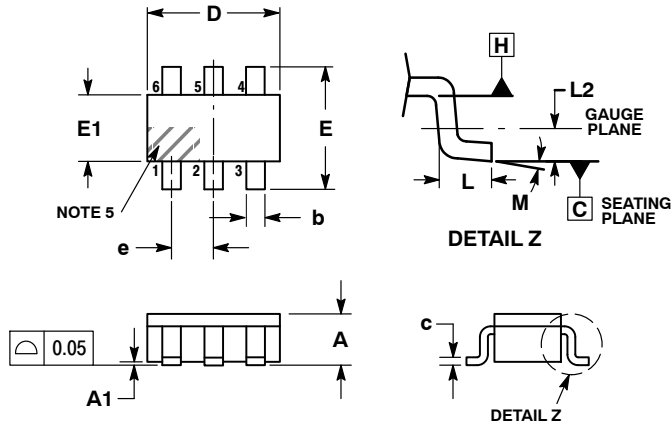


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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## PACKAGE DIMENSIONS

### TSOP-6 CASE 318G-02 ISSUE V

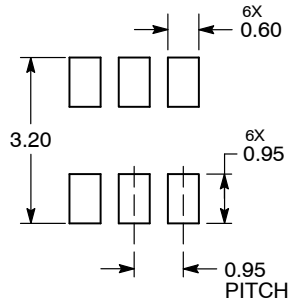


**NOTES:**

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

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