# **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  $V_{CC} = 5 \text{ V}$
- Designed for 1.65 V to 5.5 V V<sub>CC</sub> Operation
- Over Voltage Tolerant Inputs and Outputs
- LVTTL 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
- Pb-Free Packages are Available

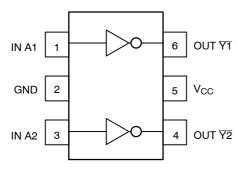


Figure 1. Pinout (Top View)

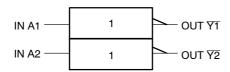


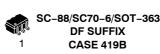
Figure 2. Logic Symbol



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# MARKING DIAGRAMS







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**

1	IN A1
2	GND
3	IN A2
4	OUT Y2
5	V <sub>CC</sub>
6	OUT Y1

# **FUNCTION TABLE**

A Input	▼ Output
L	Н
Н	L

#### ORDERING INFORMATION

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

#### **MAXIMUM RATINGS**

Characteristics		Symbol	Value	Unit
DC Supply Voltage		V <sub>CC</sub>	-0.5 to +7.0	V
DC Input Voltage		VI	$-0.5 \le V_{I} \le +7.0$	V
DC Output Voltage Output in HIGH of	or LOW State (Note 1)	Vo	$-0.5 \le V_0 \le 7.0$	V
DC Input Diode Current	V <sub>I</sub> < GND	I <sub>IK</sub>	-50	mA
DC Output Diode Current	V <sub>O</sub> < GND	I <sub>OK</sub>	-50	mA
DC Output Source/Sink Current		Io	±50	mA
DC Supply Current Per Supply Pin		I <sub>CC</sub>	±100	mA
DC Ground Current Per Ground Pin		I <sub>GND</sub>	±100	mA
Storage Temperature Range		T <sub>STG</sub>	-65 to +150	°C
Power Dissipation in Still Air SC-	-88, TSOP-6 (Note 2)	$P_{D}$	200	mW
Thermal Resistance SC	-88, TSOP-6 (Note 2)	$\theta_{\sf JA}$	333	°C/W
Lead temperature, 1 mm from Case for 10 Seconds		TL	260	°C
Junction Temperature Under Bias		TJ	+150	°C
M	n Body Model (Note 3) achine Model (Note 4) Device Model (Note 5)	V <sub>ESD</sub>	> 2000 > 200 N/A	V

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.

- I<sub>O</sub> absolute maximum rating must be observed.
   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

# **RECOMMENDED OPERATING CONDITIONS**

Parameter	r	Symbol	Min	Max	Unit
Supply Voltage	Operating Data Retention Only	V <sub>CC</sub>	1.65 1.5	5.5 5.5	V
Input Voltage		VI	0	5.5	V
Output Voltage	(HIGH or LOW State)	Vo	0	5.5	V
Operating Free-Air Temperature		T <sub>A</sub>	-55	+125	°C
Input Transition Rise or Fall Rate	$V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ $V_{CC} = 3.0 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	Δt/ΔV	0 0 0	20 10 5	ns/V

#### DC ELECTRICAL CHARACTERISTICS

		$V_{CC}$ $T_A = 25^{\circ}C$ $-55^{\circ}C \le T_A \le 125^{\circ}$			T <sub>A</sub> = 25°C			_ <sub>A</sub> ≤ 125°C	
Parameter	Condition	Symbol	(V)	Min	Тур	Max	Min	Max	Unit
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	I <sub>OH</sub> = -100 μA	V <sub>OH</sub>	1.65 to 5.5	V <sub>CC</sub> - 0.1	$V_{CC}$		V <sub>CC</sub> - 0.1		V
Voltage V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -3 mA		1.65	1.29	1.52		1.29		
THE TIE	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	I <sub>OL</sub> = 100 μA	V <sub>OL</sub>	1.65 to 5.5			0.1		0.1	V
Voltage V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 3 mA		1.65		0.08	0.24		0.24	
- IIV - IIT	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> = V <sub>CC</sub> or GND	I <sub>IN</sub>	0 to 5.5			±0.1		±1.0	μΑ
Power Off-Output Leakage Current	V <sub>OUT</sub> = 5.5 V	I <sub>OFF</sub>	0			1		10	μΑ
Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	Icc	1.65 to 5.5			1		10	μΑ

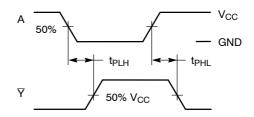
# AC ELECTRICAL CHARACTERISTICS $t_R$ = $t_F$ = 2.5 ns; $C_L$ = 50 pF; $R_L$ = 500 $\Omega$

			V <sub>CC</sub>	T <sub>A</sub> = 25°C		$-55$ °C ≤ $T_A$ ≤ 125°C			
Parameter	Condition	Symbol	(V)	Min	Тур	Max	Min	Max	Unit
Propagation Delay	$R_L = 1 M\Omega, C_L = 15 pF$	t <sub>PLH</sub>	1.65	1.8	2.3	9.2	1.8	11.0	ns
(Figure 3 and 4)	$R_L = 1 \text{ M}\Omega, C_L = 15 \text{ pF}$	t <sub>PHL</sub>	1.8	1.8	4.4	7.6	1.8	8.4	
	$R_L = 1 M\Omega, C_L = 15 pF$		2.5 ± 0.2	1.2	3.0	5.1	1.2	5.6	
	$R_L$ = 1 M $\Omega$ , $C_L$ = 15 pF		3.3 ± 0.3	0.8	2.2	3.4	0.8	3.8	
	$R_L = 500 \ \Omega, C_L = 50 \ pF$			1.2	2.9	4.5	1.2	5.0	
	$R_L = 1 \text{ M}\Omega$ , $C_L = 15 \text{ pF}$		5.0 ± 0.5	0.5	18	2.8	0.5	3.1	
	$R_L = 500 \Omega, C_L = 50 pF$			0.8	2.3	3.6	0.8	4.0	

#### **CAPACITIVE CHARACTERISTICS**

Parameter	Symbol	Condition	Typical	Unit
Input Capacitance	C <sub>IN</sub>	$V_{CC}$ = 5.5 V, $V_{I}$ = 0 V or $V_{CC}$	2.5	pF
Power Dissipation Capacitance (Note 6)	C <sub>PD</sub>	10 MHz, $V_{CC}$ = 3.3 V, $V_I$ = 0 V or $V_{CC}$ 10 MHz, $V_{CC}$ = 5.5 V, $V_I$ = 0 V or $V_{CC}$	9 11	pF

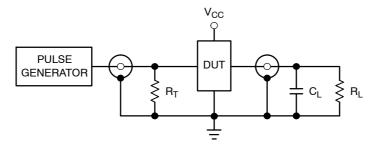
<sup>6.</sup> C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</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>.



### **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

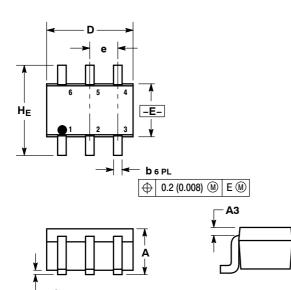
# **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
NL27WZ04DFT2	SC-88/SC70-6/SOT-363	
NL27WZ04DFT2G	SC-88/SC70-6/SOT-363 (Pb-Free)	3000 / Tape & Reel
NL27WZ04DTT1	TSOP-6	— Sooo / Tape & neel
NL27WZ04DTT1G	TSOP-6 (Pb-Free)	

<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.

# **PACKAGE DIMENSIONS**

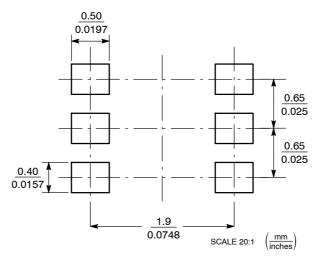
## SC-88/SC70-6/SOT-363 CASE 419B-02 **ISSUE W**



- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. 419B-01 OBSOLETE, NEW STANDARD 419B-02.

	MILLIMETERS				INCHES	;
DIM	MIN	NOM	MAX	MIN	NOM	MAX
Α	0.80	0.95	1.10	0.031	0.037	0.043
<b>A</b> 1	0.00	0.05	0.10	0.000	0.002	0.004
А3		0.20 REF			0.008 RI	ΕF
b	0.10	0.21	0.30	0.004	0.008	0.012
C	0.10	0.14	0.25	0.004	0.005	0.010
D	1.80	2.00	2.20	0.070	0.078	0.086
Е	1.15	1.25	1.35	0.045	0.049	0.053
е		0.65 BS	С	0	.026 BS	С
L	0.10	0.20	0.30	0.004	0.008	0.012
He	2.00	2 10	2 20	0.078	0.082	0.086

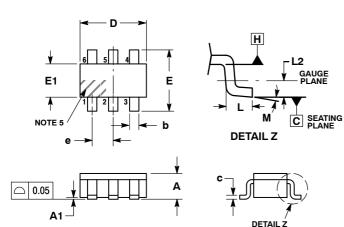
### **SOLDERING FOOTPRINT\***



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

#### PACKAGE DIMENSIONS

### TSOP-6 CASE 318G-02 **ISSUE U**

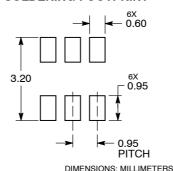


#### NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994. CONTROLLING DIMENSION: MILLIMETERS.
- MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
- 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.

	MILLIMETERS						
DIM	MIN NOM MAX						
Α	0.90	1.00	1.10				
A1	0.01	0.06	0.10				
b	0.25	0.38	0.50				
С	0.10	0.18	0.26				
D	2.90	3.00	3.10				
Е	2.50	2.75	3.00				
E1	1.30	1.50	1.70				
е	0.85	0.95	1.05				
L	0.20	0.40	0.60				
L2	0.25 BSC						
M	0° – 10°						

# **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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