

# NL17SV04

## Single Inverter

The NL17SV04 is an ultra-high performance inverter manufactured in 0.35  $\mu\text{m}$  technology, with excellent performance down to 0.9 V. This device is ideal for extremely high speed and high-drive applications. Additionally, limitations of board space are no longer a constraint. The very small SOT-553 makes this device fit most tight designs and spaces.

### Features

- Extremely High Speed:  $t_{PD} = 1.0 \text{ ns}$  (Typ) @  $V_{CC} = 3.3 \text{ V}$
- Designed for 0.9 to 3.6 V Operation
- Overvoltage Tolerance (OVT)\* Input Pins Permits Logic Translation
- Balanced  $\pm 24 \text{ mA}$  Output Drive @  $V_{CC} 3.3 \text{ Volts}$
- Near Zero Static Supply Current
- Ultra-Tiny SOT-553 5 Pin Package only 1.6 x 1.6 x 0.6 mm
- These Devices are Pb-Free and are RoHS Compliant

### Typical Applications

- Cellular
- Digital Camera
- PDA
- Digital Video

### Industry Leadership

- Functionally Similar to NC7SV04 and SN74AUC1G04

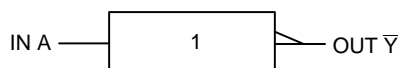


Figure 1. Logic Symbol

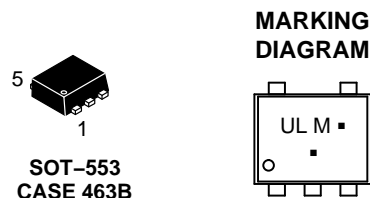
FUNCTION TABLE

Input A	Output $\bar{Y}$
L	H
H	L



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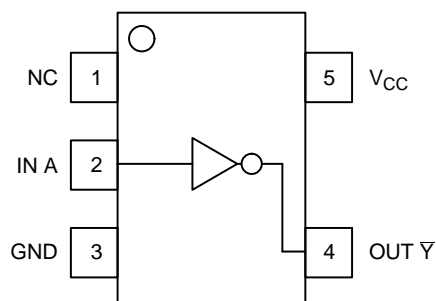
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UL = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### PIN DIAGRAM



### PIN ASSIGNMENT

PIN #	FUNCTION
1	NC
2	IN A
3	GND
4	OUT $\bar{Y}$
5	$V_{CC}$

### ORDERING INFORMATION

Device	Package	Shipping†
NL17SV04XV5T2G	SOT-553 (Pb-Free)	4000 Tape & Reel (178 mm)

†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.

\*Overvoltage Tolerance (OVT) enables input pins to function outside (higher) of their operating voltages, with no damage to the devices or to signal integrity.

# MAXIMUM RATINGS

Symbol	Rating	Value	Units
$V_{CC}$	DC Supply Voltage	−0.5 to +4.6	V
$V_I$	DC Input Voltage	−0.5 to +4.6	V
$V_O$	DC Output Voltage	−0.5 to $V_{CC} + 0.5$	V
$I_{IK}$	DC Input Diode Current $V_{IN} < 0$ V	−50	mA
$I_{OK}$	DC Output Diode Current $V_{OUT} < 0$ V $V_{OUT} > V_{CC}$	−50 +50	mA
$I_O$	DC Output Sink Current	±50	mA
$I_{CC}$	DC Supply Current per Supply Pin	±50	mA
$I_{GND}$	DC Ground Current per Ground Pin	±50	mA
$T_{STG}$	Storage Temperature Range	−65 to +150	°C
$T_L$	Lead Temperature, 1.0 mm from Case for 10 seconds	260	°C
$T_J$	Junction Temperature Under Bias	+150	°C
$\theta_{JA}$	Thermal Resistance (Note 1)	250	°C/W
$P_D$	Power Dissipation in Still Air at 85°C	250	mW
MSL	Moisture Sensitivity	Level 1	
$F_R$	Flammability Rating Oxygen index: 28 to 34	UL 94 V−0 @ 0125 in	
$V_{ESD}$	ESD Withstand Voltage Human Body Model (Note 2) Machine Model (Note 3)	4000 200	V

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. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace no air flow.
2. Tested to EIA/JESD22-A114-A.
3. Tested to EIA/JESD22-A115-A.

# RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Units
$V_{CC}$	Positive DC Supply Voltage	0.9	3.6	V
$V_{IN}$	Digital Input Voltage	0	3.6	V
$V_{out}$	Output Voltage	0	$V_{CC}$	V
$I_{OH}/I_{OL}$	Output Current $V_{CC} = 3.0$ V to 3.6 V $V_{CC} = 2.3$ V to 2.7 V $V_{CC} = 1.65$ V to 1.95 V $V_{CC} = 1.4$ V to 1.6 V $V_{CC} = 1.1$ V to 1.3 V $V_{CC} = 0.9$ V		±24 ±18 ±6 ±4 ±2 ±0.1	mA
$t_A$	Operating Temperature Range. All Package Types	−40	+85	°C
$t_r, t_f$	Input Rise or Fall Time $V_{CC} = 3.3$ V ± 0.3 V	0	10	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.

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## DC CHARACTERISTICS – Digital Section (Voltages Referenced to GND)

Symbol	Parameter	Condition	V <sub>CC</sub>	T <sub>A</sub> = 25°C		T <sub>A</sub> = -40 to 85°C		Units
				Min	Max	Min	Max	
V <sub>IH</sub>	High Level Input Voltage		0.90 1.10 ≤ V <sub>CC</sub> ≤ 1.30 1.40 ≤ V <sub>CC</sub> ≤ 1.60 1.65 ≤ V <sub>CC</sub> ≤ 1.95 2.30 ≤ V <sub>CC</sub> ≤ 2.70 2.70 ≤ V <sub>CC</sub> ≤ 3.60	0.65 x V <sub>CC</sub> 0.65 x V <sub>CC</sub> 0.65 x V <sub>CC</sub> 0.65 x V <sub>CC</sub> 1.6 2.0		0.65 x V <sub>CC</sub> 0.65 x V <sub>CC</sub> 0.65 x V <sub>CC</sub> 0.65 x V <sub>CC</sub> 1.6 2.0		V
V <sub>IL</sub>	Low Level Input Voltage		0.90 1.10 ≤ V <sub>CC</sub> ≤ 1.30 1.40 ≤ V <sub>CC</sub> ≤ 1.60 1.65 ≤ V <sub>CC</sub> ≤ 1.95 2.30 ≤ V <sub>CC</sub> ≤ 2.70 2.70 ≤ V <sub>CC</sub> ≤ 3.60		0.35 x V <sub>CC</sub> 0.35 x V <sub>CC</sub> 0.35 x V <sub>CC</sub> 0.35 x V <sub>CC</sub> 0.7 0.8		0.35 x V <sub>CC</sub> 0.35 x V <sub>CC</sub> 0.35 x V <sub>CC</sub> 0.35 x V <sub>CC</sub> 0.7 0.8	V
V <sub>OH</sub>	High Level Output Voltage	I <sub>OH</sub> = -100 μA	0.90 1.10 ≤ V <sub>CC</sub> ≤ 1.30 1.40 ≤ V <sub>CC</sub> ≤ 1.60 1.65 ≤ V <sub>CC</sub> ≤ 1.95 2.30 ≤ V <sub>CC</sub> ≤ 2.70 2.70 ≤ V <sub>CC</sub> ≤ 3.60	V <sub>CC</sub> - 0.1 V <sub>CC</sub> - 0.1 V <sub>CC</sub> - 0.2 V <sub>CC</sub> - 0.2 V <sub>CC</sub> - 0.2 V <sub>CC</sub> - 0.2		V <sub>CC</sub> - 0.1 V <sub>CC</sub> - 0.1 V <sub>CC</sub> - 0.2 V <sub>CC</sub> - 0.2 V <sub>CC</sub> - 0.2 V <sub>CC</sub> - 0.2		V
		I <sub>OH</sub> = -2.0 mA	1.10 ≤ V <sub>CC</sub> ≤ 1.30	0.75 x V <sub>CC</sub>		0.75 x V <sub>CC</sub>		
		I <sub>OH</sub> = -4.0 mA	1.40 ≤ V <sub>CC</sub> ≤ 1.60	0.75 x V <sub>CC</sub>		0.75 x V <sub>CC</sub>		
		I <sub>OH</sub> = -6.0 mA	1.65 ≤ V <sub>CC</sub> ≤ 1.95 2.30 ≤ V <sub>CC</sub> ≤ 2.70	1.25 2.0		1.25 2.0		
		I <sub>OH</sub> = -12 mA	2.30 ≤ V <sub>CC</sub> ≤ 2.70 2.70 < V <sub>CC</sub> ≤ 3.60	1.8 2.2		1.8 2.2		
		I <sub>OH</sub> = -18 mA	2.30 ≤ V <sub>CC</sub> ≤ 2.70 2.70 < V <sub>CC</sub> ≤ 3.60	1.7 2.4		1.7 2.4		
		I <sub>OH</sub> = -24 mA	2.70 ≤ V <sub>CC</sub> ≤ 3.60	2.2		2.2		
V <sub>OL</sub>	Low Level Output Voltage	I <sub>OL</sub> = 100 μA	0.90 1.10 ≤ V <sub>CC</sub> ≤ 1.30 1.40 ≤ V <sub>CC</sub> ≤ 1.60 1.65 ≤ V <sub>CC</sub> ≤ 1.95 2.30 ≤ V <sub>CC</sub> ≤ 2.70 2.70 ≤ V <sub>CC</sub> ≤ 3.60		0.1 0.1 0.2 0.2 0.2 0.2		0.1 0.1 0.2 0.2 0.2 0.2	V
		I <sub>OL</sub> = 2.0 mA	1.10 ≤ V <sub>CC</sub> ≤ 1.30		0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>	
		I <sub>OL</sub> = 4.0 mA	1.40 ≤ V <sub>CC</sub> ≤ 1.60		0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>	
		I <sub>OL</sub> = 6.0 mA	1.65 ≤ V <sub>CC</sub> ≤ 1.95		0.3		0.3	
		I <sub>OL</sub> = 12 mA	2.30 ≤ V <sub>CC</sub> ≤ 2.70 2.70 < V <sub>CC</sub> ≤ 3.60		0.4 0.4		0.4 0.4	
		I <sub>OL</sub> = 18 mA	2.30 ≤ V <sub>CC</sub> ≤ 2.70 2.70 < V <sub>CC</sub> ≤ 3.60		0.6 0.4		0.6 0.4	
		I <sub>OL</sub> = 24 mA	2.70 ≤ V <sub>CC</sub> ≤ 3.60		0.55		0.55	
I <sub>IN</sub>	Input Leakage Current	0 = V <sub>I</sub> = 3.6 V	0.90 to 3.60		±0.1		±0.9	μA
I <sub>OFF</sub>	Power Off Leakage Current		0		1		5	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>I</sub> = V <sub>CC</sub> or GND	0.90 to 3.60		0.9		5	μA

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## AC CHARACTERISTICS (Input $t_r = t_f = 3.0$ nS)

Symbol	Parameter	-40°C		25°C			85°C		Units
		Condition	V <sub>CC</sub>	Min	Typ	Max	Min	Max	
T <sub>PHL</sub> , T <sub>PLH</sub>	Propagation Delay	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1.0 MΩ	0.90		12				nS
		C <sub>L</sub> = 15 pF, R <sub>L</sub> = 2.0 kΩ	1.10 ≤ V <sub>CC</sub> ≤ 1.30 1.40 ≤ V <sub>CC</sub> ≤ 1.60	2.0 1.0	6.0 3.2	9.0 5.1	1.0 1.0	13.9 6.0	nS
		C <sub>L</sub> = 30 pF, R <sub>L</sub> = 500 Ω	1.65 ≤ V <sub>CC</sub> ≤ 1.95 2.30 ≤ V <sub>CC</sub> ≤ 2.70 2.70 ≤ V <sub>CC</sub> ≤ 3.60	1.0 0.8 0.7	2.0 1.2 1.0	4.2 2.7 2.3	1.0 0.7 0.6	5.2 3.4 2.8	nS
C <sub>IN</sub>	Input Capacitance		0		2.0				pF
C <sub>OUT</sub>	Output Capacitance		0		4.5				pF
C <sub>PD</sub>	Power Dissipation Capacitance	V <sub>I</sub> = 0 V or V <sub>CC</sub> F = 10 MHz	0.90 to 3.60		20				pF

## DEVICE JUNCTION TEMPERATURE VERSUS TIME TO 0.1% BOND FAILURES

Junction Temperature °C	Time, Hours	Time, Years
80	1,032,200	117.8
90	419,300	47.9
100	178,700	20.4
110	79,600	9.4
120	37,000	4.2
130	17,800	2.0
140	8,900	1.0

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## AC LOADINGS AND WAVEFORMS

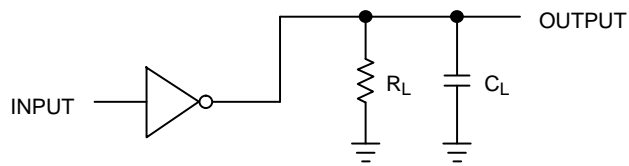


Figure 2. AC Test Circuit

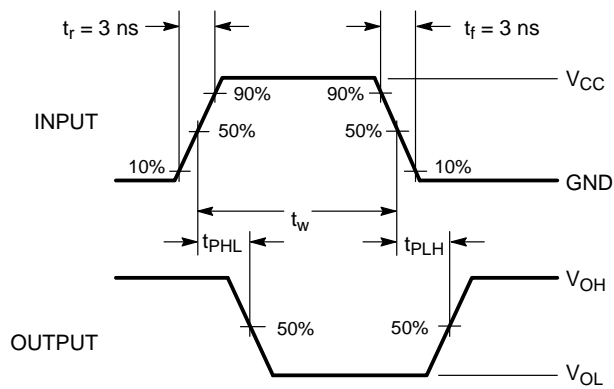


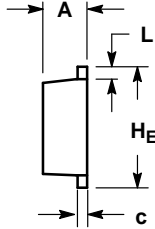
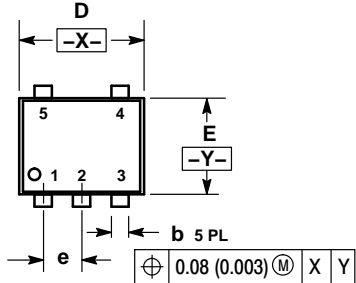
Figure 3. AC Waveforms

Symbol	V <sub>CC</sub>					
	3.3 V ± 0.3 V	2.5 V ± 0.2 V	1.8 V ± 0.15 V	1.5 V ± 0.1 V	1.2 V ± 0.1 V	0.9 V
V <sub>mi</sub>	1.5 V	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2
V <sub>mo</sub>	1.5 V	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2

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## PACKAGE DIMENSIONS

### SOT-553, 5 LEAD CASE 463B ISSUE C

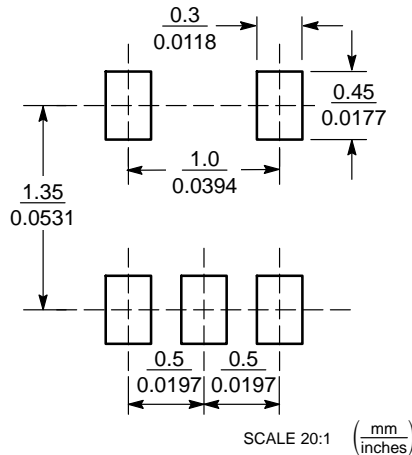


#### NOTES:


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

### 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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