# **Single Inverter**

The NL17SG04 MiniGate  $^{\text{\tiny M}}$  is an advanced high-speed CMOS Inverter in ultra-small footprint.

The NL17SG04 input structures provides protection when voltages up to 4.6 V are applied.

#### **Features**

- Wide Operating V<sub>CC</sub> Range: 0.9 V to 3.6 V
- High Speed:  $t_{PD} = 2.5$  ns (Typ) at  $V_{CC} = 3.0$  V,  $C_L = 15$  pF
- Low Power Dissipation:  $I_{CC} = 0.5 \mu A$  (Max) at  $T_A = 25^{\circ}C$
- 4.6 V Overvoltage Tolerant (OVT) Input Pins
- Ultra-Small Packages
- These are Pb-Free and Halide-Free Devices

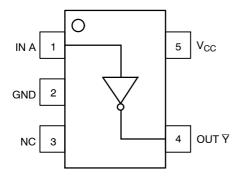


Figure 1. Pinout (Top View)

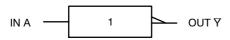


Figure 2. Logic Symbol



### ON Semiconductor®

http://onsemi.com

MARKING DIAGRAM



SOT-953 CASE 527AE



V = Specific Device Code

M = Month Code

PIN ASSIGNMENT					
1	IN A				
2	GND				
3	NC				
4	OUT $\overline{Y}$				
5	V <sub>CC</sub>				

### **FUNCTION TABLE**

A Input	₹ Output
L	Н
Н	L

### **ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

#### **MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit	
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +5.5	V	
V <sub>IN</sub>	DC Input Voltage		-0.5 to +5.5	V
V <sub>OUT</sub>	DC Output Voltage		-0.5 to V <sub>CC</sub> +0.5	٧
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < GND	-20	mA
lok	DC Output Diode Current	V <sub>OUT</sub> < GND, V <sub>OUT</sub> > V <sub>CC</sub>	±20	mA
l <sub>out</sub>	DC Output Source/Sink Current		±20	mA
I <sub>CC</sub>	DC Supply Current per Supply Pin	±20	mA	
I <sub>GND</sub>	DC Ground Current per Ground Pin	±20	mA	
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C	
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C	
TJ	Junction Temperature Under Bias	+150	°C	
MSL	Moisture Sensitivity		Level 1	
F <sub>R</sub>	Flammability Rating	UL 94 V-0 @ 0.125 in		
V <sub>ESD</sub>	ESD Withstand Voltage	Human Body Model (Note 2) Machine Model (Note 3)	>2000 >100	V
I <sub>LATCHUP</sub>	Latchup Performance Above V <sub>CC</sub>	and Below GND at 125°C (Note 4)	±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. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.

- Tested to EIA/JESD22-A114-A.
   Tested to EIA/JESD22-A115-A.
- 4. Tested to EIA/JESD78.

### **RECOMMENDED OPERATING CONDITIONS**

Symbol	Characteristics	Min	Max	Unit
V <sub>CC</sub>	Positive DC Supply Voltage	0.9	4.6	V
V <sub>IN</sub>	Digital Input Voltage	0.0	4.6	V
V <sub>OUT</sub>	Output Voltage	0.0	$V_{CC}$	V
T <sub>A</sub>	Operating Temperature Range	-55	+125	°C
$\Delta t / \Delta V$	Input Transition Rise or Fail Rate $V_{CC}$ = 3.3 V $\pm$ 0.3 V	0	10	ns/V

### DC ELECTRICAL CHARACTERISTICS

					T <sub>A</sub> = 25°C		T <sub>A</sub> = -55°C to +125°C			
Symbol	Parameter	C	onditions	V <sub>CC</sub> (V)	Min	Max	Min	Max	Unit	
V <sub>IH</sub>	High-Level Input			0.9	V <sub>CC</sub>		V <sub>CC</sub>		V	
	Voltage			1.1 to 1.3	0.7xV <sub>CC</sub>		0.7xV <sub>CC</sub>			
				1.4 to 1.6	0.65xV <sub>CC</sub>		0.65xV <sub>CC</sub>			
				1.65 to 1.95	0.65xV <sub>CC</sub>		0.65xV <sub>CC</sub>			
				2.3 to 2.7	1.7		1.7			
				3.0 to 3.6	2.0		2.0			
V <sub>IL</sub>	Low-Level Input			0.9		GND		GND	V	
	Voltage			1.1 to 1.3		0.3xV <sub>CC</sub>		0.3xV <sub>CC</sub>		
				1.4 to 1.6		0.35xV <sub>CC</sub>		0.35xV <sub>CC</sub>		
				1.65 to 1.95		0.35xV <sub>CC</sub>		0.35xV <sub>CC</sub>		
				2.3 to 2.7		0.7		0.7		
				3.0 to 3.6		0.8		0.8		
V <sub>OH</sub>	High-Level Output Voltage	.,	I <sub>OH</sub> = -20 μA	0.9	0.75		0.75		V	
0			I <sub>OH</sub> = -0.3 mA	1.1 to 1.3	0.75xV <sub>CC</sub>		0.75xV <sub>CC</sub>			
			I <sub>OH</sub> = -1.7 mA	1.4 to 1.6	0.75xV <sub>CC</sub>		0.75xV <sub>CC</sub>			
			I <sub>OH</sub> = -3.0 mA	1.65 to 1.95	Vcc-0.45		Vcc-0.45			
			I <sub>OH</sub> = -4.0 mA	2.3 to 2.7	2.0		2.0			
			I <sub>OH</sub> = -8.0 mA	3.0 to 3.6	2.48		2.48			
V <sub>OL</sub>	Low-Level Output Voltage		V <sub>IN</sub> =	I <sub>OL</sub> = 20 μA	0.9		0.1		0.1	V
		Output Voltage $V_{IH}$ or $V_{IL}$ $I_{OL} = 0.3 \text{ mA}$ 1.1 to 1	1.1 to 1.3		0.25xV <sub>CC</sub>		0.25xV <sub>CC</sub>			
			I <sub>OL</sub> = 1.7 mA	1.4 to 1.6		0.25xV <sub>CC</sub>		0.25xV <sub>CC</sub>		
			I <sub>OL</sub> = 3.0 mA	1.65 to 1.95		0.45		0.45		
			I <sub>OL</sub> = 4.0 mA	2.3 to 2.7		0.4		0.4		
			I <sub>OL</sub> = 8.0 mA	3.0 to 3.6		0.4		0.4		
I <sub>IN</sub>	Input Leakage Current	0 ≤	V <sub>IN</sub> ≤ 3.6 V	0 to 3.6		±0.1		±1.0	μΑ	
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> =	V <sub>CC</sub> or GND	3.6		0.5		10.0	μΑ	

### AC ELECTRICAL CHARACTERISTICS Input $t_{\text{r}}$ = $t_{\text{f}}$ = 3.0 ns

Symbol	Parameter	Test Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25° C		T <sub>A</sub> = -55°C to +125°C										
				Min	Тур	Max	Min	Max	Unit							
t <sub>PLH</sub> ,	Propagation Delay,	C <sub>L</sub> = 10 pF,	0.9	-	10.0	13.3	-	17.0	ns							
t <sub>PHL</sub>	A or B to Y	$R_L = 1 M\Omega$	1.1 to 1.3	-	8.7	11.2	-	14.0								
			1.4 to 1.6	-	4.9	8.5	-	10.0								
			1.65 to 1.95	-	3.8	6.2	-	6.7								
			2.3 to 2.7	-	2.6	3.9	-	4.4								
			3.0 to 3.6	-	2.1	3.1	-	3.7								
		C <sub>L</sub> = 15 pF,	0.9	-	11.55	13.7	-	19.7	ns							
		R <sub>L</sub> = 1 MΩ	1.1 to 1.3	-	7.2	10.8	-	15.6								
			1.4 to 1.6	-	5.4	9.3	-	11.2								
			1.65 to 1.95	-	4.2	6.9	-	7.1								
										2.3 to 2.7	-	2.8	4.4	-	5.0	
			3.0 to 3.6	-	2.3	3.4	-	3.9								
		C <sub>L</sub> = 30 pF,	0.9	-	16.85	18.9	-	22.3	ns							
		$R_L = 1 M\Omega$	1.1 to 1.3	-	10.2	13.4	-	17.5								
			1.4 to 1.6	-	7.4	13.1	-	15.9								
					l				1.65 to 1.95	-	5.6	9.2	-	9.6		
			2.3 to 2.7	-	3.7	5.7	-	6.1	1							
			3.0 to 3.6	-	2.9	4.4	-	4.8								
C <sub>IN</sub>	Input Capacitance		0 to 3.6		3	-	-	-	pF							
C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)	f = 10 MHz	0.9 to 3.6	-	4	-	-	-	pF							

<sup>5.</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>.

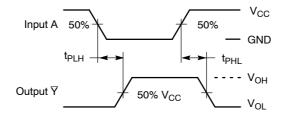
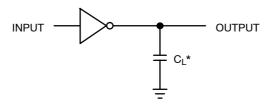


Figure 3. Switching Waveforms



\*Includes all probe and jig capacitance. A 1-MHz square input wave is recommended for propagation delay tests.

Figure 4. Test Circuit

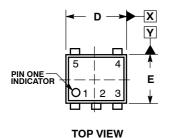
### **ORDERING INFORMATION**

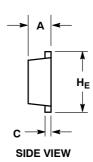
Device	Package	Shipping <sup>†</sup>
NL17SG04P5T5G	SOT-953 (Pb-Free)	8000 / Tape & Reel

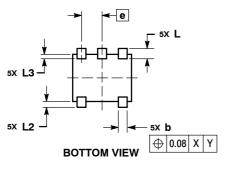
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

### PACKAGE DIMENSIONS

### SOT-953 CASE 527AE **ISSUE E**





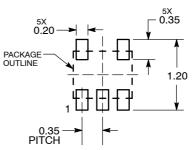


#### NOTES

- 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 THE BASE MATERIAL.
  DIMENSIONS D AND E DO NOT INCLUDE MOLD
- FLASH, PROTRUSIONS, OR GATE BURRS.

	MILLIMETERS					
DIM	MIN	NOM	MAX			
Α	0.34	0.37	0.40			
b	0.10	0.15	0.20			
С	0.07	0.12	0.17			
D	0.95	1.00	1.05			
E	0.75	0.80	0.85			
е		0.35 BS	С			
HE	0.95	1.00	1.05			
L	0.175 REF					
L2	0.05	0.10	0.15			
L3		0.15				

#### 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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