# **Buffer with Open Drain Output**

The NL17SG07 MiniGate<sup>™</sup> is an advanced high-speed CMOS Buffer with Open Drain Output in ultra-small footprint.

The NL17SG07 input structures provides protection when voltages up to 5.5~V are applied with  $V_{CC}$  greater than or equal to 0.9 volts, otherwise the protection is up to 4.6 volts regardless of the supply voltage.

#### **Features**

- $\bullet~$  Wide Operating  $V_{CC}$  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  $T_A = 25^{\circ}C$
- 5.5 V Overvoltage Tolerant (OVT) Input Pins ( $V_{CC} \ge 0.9 \text{ V}$ )
- Ultra-Small Packages
- These are Pb-Free and Halide-Free Devices

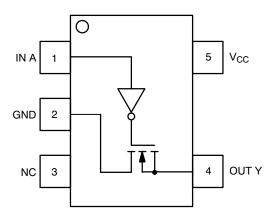


Figure 1. Pinout (Top View)



Figure 2. Logic Symbol

1



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MARKING DIAGRAM



SOT-953 CASE 527AE



6 = Specific Device Code

M = Month Code

PIN ASSIGNMENT				
1	IN A			
2	GND			
3	NC			
4	OUT Y			
5	V <sub>CC</sub>			

#### **FUNCTION TABLE**

Input A	Output Y
L	L
Н	Z

### 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 +4.6	V
V <sub>OUT</sub>	DC Output Voltage	Output at High or Low State ower-Down Mode (V <sub>CC</sub> = 0 V)	-0.5 to V <sub>CC</sub> + 0.5 -0.5 to +4.6	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < GND	-20	mA
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < GND	-20	mA
lout	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
TL	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	Oxygen Index: 28 to 34	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>	Latch-up Performance above V <sub>CC</sub> and below GND at 12	5°C (Note 4)	±75	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.

2. Tested to EIA/JESD22-A114-A.

- 3. 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	3.6	V
V <sub>IN</sub>	Digital Input Voltage		0.0	3.6	V
V <sub>OUT</sub>	Output Voltage Output at High or Low Power-Down Mode (V <sub>CC</sub> =	State 0 V)	0.0 0.0	V <sub>CC</sub> 3.6	V
T <sub>A</sub>	Operating Temperature Range		-55	+125	°C
Δt / ΔV	Input Transition Rise or Fail Rate $V_{CC} = 3.3 \text{ V} \pm$	0.3 V	0	10	ns/V

## DC ELECTRICAL CHARACTERISTICS

		Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			-55°C ≤ T <sub>A</sub> ≤ 125°C			
Symbol Parameter	Min			Тур	Max	Min	Max	Unit		
V <sub>IH</sub> High-Level			0.9	V <sub>CC</sub>			V <sub>CC</sub>			
	Input Voltage			1.1 to 1.3	0.70 x V <sub>CC</sub>			0.70 x V <sub>CC</sub>		
				1.4 to 1.6	0.65 x V <sub>CC</sub>			0.65 x V <sub>CC</sub>		V
				1.65 to 1.95	0.65 x V <sub>CC</sub>			0.65 x V <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			0.9			GND		GND	
	Input Voltage			1.1 to 1.3			0.30 x V <sub>CC</sub>		0.30 x V <sub>CC</sub>	
				1.4 to 1.6			0.35 x V <sub>CC</sub>		0.35 x V <sub>CC</sub>	V
				1.65 to 1.95			0.35 x V <sub>CC</sub>		0.35 x V <sub>CC</sub>	
				2.3 to 2.7			0.7		0.7	
				3.0 to 3.6			0.8		0.8	
V <sub>OL</sub>	Low-Level	V <sub>IN</sub> =	I <sub>OL</sub> = 20 μA	0.9			0.1		0.1	V
	Output Voltage	V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 0.3 mA	1.1 to 1.3			0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>	
			I <sub>OL</sub> = 1.7 mA	1.4 to 1.6			0.25 x V <sub>CC</sub>		0.25 x V <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	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	$0 \le V_{IN} \le 3.6 \text{ V}$		0 to 3.6			±0.1		±1.0	μА
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND		3.6			0.5		10	μΑ

#### AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0 \text{ ns}$ )

					T <sub>A</sub> = 25°C		T⊿ –55°C to	չ = o +125°C	
Symbol	Parameter	Test Condition	V <sub>CC</sub> (V)	Min	Тур	Max	Min	Max	Unit
t <sub>PZL</sub>	Propagation Delay,	C <sub>L</sub> = 10 pF,	0.9	_	12	-	-	-	ns
	Enable Time,	$R_1 = R_L = 5 \text{ k}\Omega$	1.1 to 1.3	-	5.5	6.8	-	8.8	1
	A to Y		1.4 to 1.6	_	4.0	5.7	-	7.3	1
			1.65 to 1.95	_	3.3	3.9	-	5.9	
			2.3 to 2.7	_	2.7	3.3	-	4.5	
			3.0 to 3.6	_	2.4	2.9	-	3.7	1
		C <sub>L</sub> = 15 pF,	0.9	_	12.5	_	-	-	ns
		$R_1 = R_L = 5 \text{ k}\Omega$	1.1 to 1.3	_	5.8	7.0	-	9.0	1
			1.4 to 1.6	_	4.1	6.0	-	7.4	1
			1.65 to 1.95	_	3.4	4.0	_	6.2	1
			2.3 to 2.7	_	2.8	3.4	_	4.6	1
			3.0 to 3.6	_	2.5	3.0	_	3.7	1
		C <sub>L</sub> = 30 pF,	0.9	_	13.2	_	_	_	ns
		$R_1 = R_L = 5 \text{ k}\Omega$	1.1 to 1.3	_	6.2	7.4	_	9.4	- - -
			1.4 to 1.6	_	4.5	6.2	_	7.6	
			1.65 to 1.95	_	3.5	4.2	_	6.4	
			2.3 to 2.7	_	3.0	3.6	_	4.7	
			3.0 to 3.6	_	2.6	3.1	_	3.9	
t <sub>PLZ</sub>	Propagation Delay,	$C_L = 10 \text{ pF},$ $R_1 = R_L = 5 \text{ k}\Omega$	0.9	_	8.0	_	-	_	ns
	Disable Time,		1.1 to 1.3	_	6.5	10.9	-	11.5	
	A to Y		1.4 to 1.6	_	5.2	7.2	_	8.3	
			1.65 to 1.95	_	4.9	7.0	_	7.8	
			2.3 to 2.7	_	3.8	6.5	-	7.3	
			3.0 to 3.6	_	3.5	6.2	-	6.8	
		C <sub>L</sub> = 15 pF,	0.9	_	11.1	_	_	-	ns
		$R_1 = R_L = 5 \text{ k}\Omega$	1.1 to 1.3	_	9.0	13.4	_	14	-
			1.4 to 1.6	_	7.9	10	_	10.8	1
			1.65 to 1.95	_	7.6	9.5	_	10.5	-
			2.3 to 2.7	_	6.3	7.8	_	10	
			3.0 to 3.6	_	6.0	7.2	_	9.3	1
		C <sub>L</sub> = 30 pF,	0.9	_	16.2	_	-	-	ns
		$R_1 = R_L = 5 \text{ k}\Omega$	1.1 to 1.3	_	14	18.4	_	20	1
			1.4 to 1.6	_	13	15	_	16	1
			1.65 to 1.95	_	12.5	14.5	_	15.8	
			2.3 to 2.7	_	11.2	13.5	_	15.4	
			3.0 to 3.6	_	11	13.2	_	14.3	1
C <sub>IN</sub>	Input Capacitance		0 to 3.6	_	3	_	_	_	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)		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 dynamic 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>.

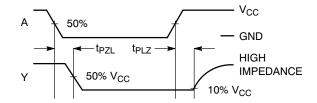


Figure 3. Switching Waveform

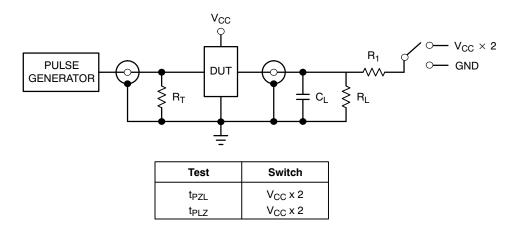


Figure 4. Test Circuit

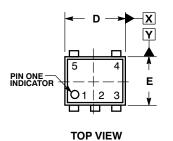
#### **ORDERING INFORMATION**

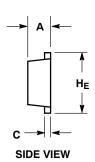
Device	Package	Shipping <sup>†</sup>
NL17SG07P5T5G	SOT-953 (Pb-Free)	8000 / Tape & Reel

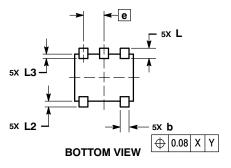
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

#### PACKAGE DIMENSIONS

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





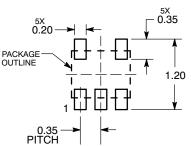


#### NOTES

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. 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				
Е	0.75	0.80	0.85				
е		0.35 BSC					
HE	0.95	1.00	1.05				
L	0.175 REF						
L2	0.05	0.10	0.15				
L3							

#### **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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