# Single Inverter with Schmitt Trigger

The NL17SZ14 is a single inverter with Schmitt trigger in two tiny footprint packages. The device performs much as LCX multi-gate products in speed and drive.

#### **Features**

- Tiny SOT-353 and SOT-553 Packages
- Source/Sink 24 mA at 3.0 V
- Over-Voltage Tolerant Inputs and Outputs
- Pin For Pin with NC7SZ14
- $\bullet$  Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation
- Chip Complexity: FET = 20
- Pb-Free Packages are Available

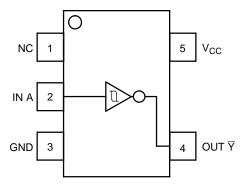


Figure 1. Pinout

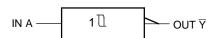


Figure 2. Logic Symbol



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MARKING DIAGRAMS



SOT-353/SC70-5/SC-88A DF SUFFIX CASE 419A





SOT-553 XV5 SUFFIX CASE 463B



LA = Device Code
M = Date Code\*
A = Assembly Location
Y = Year

W = Work Week ■ Pb–Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

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

A Input	₹ 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.

## **MAXIMUM RATINGS**

Symbol	Characteristics		Value	Unit
V <sub>CC</sub>	DC Supply Voltage		-0.5  to  +7.0	V
VI	DC Input Voltage		$-0.5 \le V_1 \le +7.0$	V
Vo	DC Output Voltage Output in High or LOV	V State (Note 1)	$-0.5 \le V_{O} \le 7.0$	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>I</sub> < GND	-50	mA
I <sub>OK</sub>	DC Output Diode Current	V <sub>O</sub> < GND	-50	mA
Io	DC Output Sink Current		±50	mA
I <sub>CC</sub>	DC Supply Current per Supply Pin		±100	mA
I <sub>GND</sub>	DC Ground Current per Ground Pin		±100	mA
T <sub>STG</sub>	Storage Temperature Range		-65 to +150	°C
P <sub>D</sub>	Power Dissipation in Still Air	SOT-353 SOT-553	186 135	mW
$\theta_{\sf JA}$	Thermal Resistance	SOT-353 SOT-553	350 496	°C/W
$T_L$	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 Oxyger	Index: 28 to 34	UL 94 V-0 @ 0.125 in	
ESD	Machine	Model (Note 2) Model (Note 3) Model (Note 4)	Class 2 Class C N/A	

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, 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 with no air flow.

2. Tested to EIA/JESD22-A114-A, rated to EIA/JESD22-A114-B.

- 3. Tested to EIA/JESD22-A115-A, rated to EIA/JESD22-A115-A.
- 4. Tested to JESD22-C101-A.

# **RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter		Min	Max	Unit
V <sub>CC</sub>	Supply Voltage	Operating Data Retention Only	1.65 1.5	5.5 5.5	V
VI	Input Voltage		0	5.5	V
Vo	Output Voltage	(High or LOW State)	0	5.5	V
T <sub>A</sub>	Operating Free–Air Temperature		<b>-40</b>	+ 85	°C
Δt/ΔV	Input Transition Rise or Fall Rate	$V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ $V_{CC} = 3.0 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	0 0 0	No Limit No Limit No Limit	ns/V

# DC ELECTRICAL CHARACTERISTICS

			V <sub>CC</sub>	T <sub>A</sub>	= 25°C		$-40^{\circ}C \le T_A \le 85^{\circ}C$		
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Unit
V <sub>T</sub> +	Positive Input		1.65	0.6	1.0	1.4	0.6	1.4	V
	Threshold Voltage		2.3	1.0	1.5	1.8	1.0	1.8	
			2.7	1.2	1.7	2.0	1.2	2.0	
			3.0	1.3	1.9	2.2	1.3	2.2	
			4.5	1.9	2.7	3.1	1.9	3.1	
			5.5	2.2	3.3	3.6	2.2	3.6	
V <sub>T</sub> -	Negative Input		1.65	0.2	0.5	8.0	0.2	0.8	V
	Threshold Voltage		2.3	0.4	0.75	1.15	0.4	1.15	1
			2.7	0.5	0.87	1.4	0.5	1.4	
			3.0	0.6	1.0	1.5	0.6	1.5	
			4.5	1.0	1.5	2.0	1.0	2.0	1
			5.5	1.2	1.9	2.3	1.2	2.3	
V <sub>H</sub>	Input Hysteresis Voltage		1.65	0.1	0.48	0.9	0.1	0.9	V
			2.3	0.25	0.75	1.1	0.25	1.1	
			2.7	0.3	0.83	1.15	0.3	1.15	
			3.0	0.4	0.93	1.2	0.4	1.2	
			4.5	0.6	1.2	1.5	0.6	1.5	
			5.5	0.7	1.4	1.7	0.7	1.7	
V <sub>OH</sub>	High-Level Output	I <sub>OH</sub> = -100 μA	1.65 to 5.5	V <sub>CC</sub> – 0.1	V <sub>CC</sub>		V <sub>CC</sub> – 0.1		V
	Voltage V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	$I_{OH} = -3 \text{ mA}$	1.65	1.29	1.52		1.29		
		$I_{OH} = -8 \text{ mA}$	2.3	1.9	2.1		1.9		
		$I_{OH} = -12 \text{ mA}$	2.7	2.2	2.4		2.2		
		$I_{OH} = -16 \text{ mA}$	3.0	2.4	2.7		2.4		
		$I_{OH} = -24 \text{ mA}$	3.0	2.3	2.5		2.3		
		$I_{OH} = -32 \text{ mA}$	4.5	3.8	4.0		3.8		
$V_{OL}$	Low-Level Output	I <sub>OL</sub> = 100 μA	1.65 to 5.5		0.0	0.1		0.1	V
	Voltage V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 4 mA	1.65		0.08	0.24	1	0.24	
		I <sub>OL</sub> = 8 mA	2.3		0.2	0.3	1	0.3	
		I <sub>OL</sub> = 12 mA	2.7		0.22	0.4	1	0.4	
		I <sub>OL</sub> = 16 mA	3.0		0.28	0.4	1	0.4	
		I <sub>OL</sub> = 24 mA	3.0	1	0.38	0.55	1	0.55	1
		I <sub>OL</sub> = 32 mA	4.5	1	0.42	0.55	1	0.55	1
I <sub>IN</sub>	Input Leakage Current	$V_{IN} = V_{CC}$ or GND	0 to 5.5	1		±0.1	1	±1.0	μΑ
I <sub>OFF</sub>	Power Off–Output Leakage Current	V <sub>OUT</sub> = 5.5 V	0			1		10	μΑ
I <sub>CC</sub>	Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5			1		10	μΑ

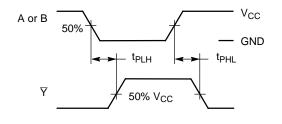
# AC ELECTRICAL CHARACTERISTICS $t_R = t_F = 3.0 \text{ ns}$

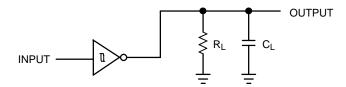
			$V_{CC}$ $T_A = 25^{\circ}C$ $-40^{\circ}C \le T_A \le 85^{\circ}C$		T <sub>A</sub> = 25°C		$T_A \leq 85^{\circ}C$		
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Unit
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay (Figure 3 and 4)	$R_L = 1 \text{ M}\Omega, C_L = 15 \text{ pF}$	1.65 1.8 2.5 ± 0.2 3.3 ± 0.3 5.0 ± 0.5	2.0 2.0 1.0 1.0 0.5	9.1 7.6 5.0 3.7 3.1	15 12.5 9.0 6.3 5.2	2.0 2.0 1.0 1.0 0.5	15.6 13 9.5 6.5 5.5	ns
		$R_L = 500 \ \Omega, C_L = 50 \ pF$	3.3 ± 0.3 5.0 ± 0.5	1.5 0.8	4.4 3.7	7.2 5.9	1.5 0.8	7.5 6.2	

## **CAPACITIVE CHARACTERISTICS**

Symbol	Parameter	Condition	Typical	Unit
C <sub>IN</sub>	Input Capacitance	$V_{CC} = 5.5 \text{ V}, V_I = 0 \text{ V or } V_{CC}$	>4.0	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)	10 MHz, $V_{CC} = 3.3 \text{ V}$ , $V_{I} = 0 \text{ V or } V_{CC}$ 10 MHz, $V_{CC} = 5.5 \text{ V}$ , $V_{I} = 0 \text{ V or } V_{CC}$	25 30	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>.





A 1–MHz square input wave is recommended for propagation delay tests.

Figure 3. Switching Waveform

Figure 4. Test Circuit

# **DEVICE ORDERING INFORMATION**

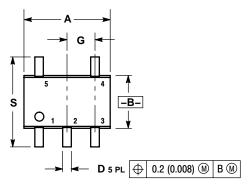
Device Order Number	Package Type	Tape and Reel Size <sup>†</sup>
NL17SZ14DFT2	SOT-353/SC70-5/SC-88A	3000 / Tape & Reel
NL17SZ14DFT2G	SOT-353/SC70-5/SC-88A (Pb-Free)	3000 / Tape & Reel
NL17SZ14XV5T2	SOT-553*	3000 / Tape & Reel
NL17SZ14XV5T2G	SOT-553*	3000 / Tape & Reel

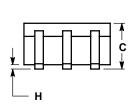
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

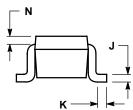
<sup>\*</sup>All Devices in Package SOT553 are Inherently Pb-Free.

# **PACKAGE DIMENSIONS**

SC-88A, SOT-353, SC-70 CASE 419A-02 **ISSUE J** 



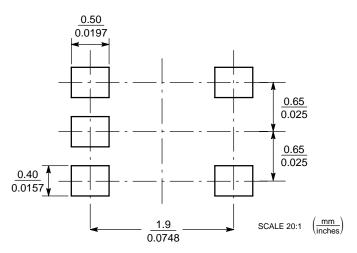




- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
  4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	INC	HES	MILLIN	IETERS	
DIM	MIN	MAX	MIN	MAX	
Α	0.071	0.087	1.80	2.20	
В	0.045	0.053	1.15	1.35	
С	0.031	0.043	0.80	1.10	
D	0.004	0.012	0.10	0.30	
G	0.026	BSC	0.65	BSC	
Н		0.004		0.10	
J	0.004	0.010	0.10	0.25	
K	0.004	0.012	0.10	0.30	
N	0.008	REF	0.20 REF		
S	0.079	0.087	2.00	2.20	

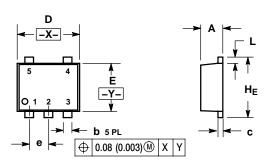
## **SOLDERING FOOTPRINT\***



\*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

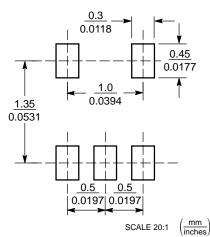
## SOT-553, 5 LEAD CASE 463B-01 ISSUE B



- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETERS
- MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL

	М	ILLIMETE	RS		INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX	
Α	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	
С	0.08	0.13	0.18	0.003	0.005	0.007	
D	1.50	1.60	1.70	0.059	0.063	0.067	
E	1.10	1.20	1.30	0.043	0.047	0.051	
е		0.50 BSC		0.020 BSC			
L	0.10	0.20	0.30	0.004	0.008	0.012	
HE	1.50	1.60	1.70	0.059	0.063	0.067	

#### **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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