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# Single Non-Inverting Buffer with Schmitt Trigger

## NL17SZ17

The NL17SZ17 is a single Non–inverting Schmitt Trigger Buffer in tiny footprint packages.

#### Features

- $\bullet\,$  Designed for 1.65 V to 5.5 V V\_{CC} Operation
- 3.7 ns  $t_{PD}$  at  $V_{CC} = 5 V (typ)$
- Input/Output Overvoltage Tolerant up to 5.5 V
- IOFF Supports Partial Power Down Protection
- Source/Sink 24 mA at 3.0 V
- Available in SC–88A, SC–74A, SOT–553, SOT–953 and UDFN6 Packages
- Chip Complexity < 100 FETs
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant



Figure 1. Logic Symbol



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		MARKING DIAGRAMS
	SC-88A DF SUFFIX CASE 419A	
-	SC-74A DBV SUFFIX CASE 318BQ	
<b>1 1 1 1 1 1 1 1 1 1</b>	SOT-553 XV5 SUFFIX CASE 463B	XX M•
and the second sec	SOT-953 P5 SUFFIX CASE 527AE	
	UDFN6 1.45 x 1.0 CASE 517AQ	● XM
Ŷ	UDFN6 1.0 x 1.0 CASE 517BX	1 <b>o</b>
XX M	= Specific Devi = Date Code* = Pb-Free Pac	
(Note: M	licrodot may be in eit	her location)
*Date Co	de orientation and/o	or position may

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

#### **ORDERING INFORMATION**

See detailed ordering, marking and shipping information in the package dimensions section on page 7 of this data sheet.







Figure 2. Pinout (Top View)

#### PIN ASSIGNMENT

(SC-88A/SOT-553/SC-74A)

Pin	Function
1	NC
2	А
3	GND
4	Y
5	V <sub>CC</sub>

#### PIN ASSIGNMENT (SOT-953)

Function
А
GND
NC
Y
V <sub>CC</sub>

#### **PIN ASSIGNMENT (UDFN)**

Pin	Function
1	NC
2	A
3	GND
4	Y
5	NC
6	V <sub>CC</sub>

#### FUNCTION TABLE

Input	Output
A	Y
L	L
Н	Н

#### MAXIMUM RATINGS

Symbol	Ch	aracteristics	Value	Unit	
$V_{CC}$	DC Supply Voltage	SC-88A (NLV) -74A, SC-88A, SOT-553, SOT-953, UDFN6	−0.5 to +7.0 −0.5 to +6.5	V	
V <sub>IN</sub>	DC Input Voltage	SC-88A (NLV) -74A, SC-88A, SOT-553, SOT-953, UDFN6	−0.5 to +7.0 −0.5 to +6.5	V	
V <sub>OUT</sub>	DC Output Voltage SC-88A (NLV)	Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V <sub>CC</sub> = 0 V)	-0.5 to V <sub>CC</sub> + 0.5 -0.5 to +7.0 -0.5 to +7.0	V	
	DC Output Voltage SC-74A, SC-88A, SOT-553, SOT-953, UDFN6	Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V <sub>CC</sub> = 0 V)	$\begin{array}{c} -0.5 \text{ to } V_{CC} + 0.5 \\ -0.5 \text{ to } +6.5 \\ -0.5 \text{ to } +6.5 \end{array}$	V	
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < GND	-50	mA	
Ι <sub>ΟΚ</sub>	DC Output Diode Current	V <sub>OUT</sub> < GND	-50	mA	
I <sub>OUT</sub>	DC Output Source/Sink Current	±50	mA		
I <sub>CC</sub> or I <sub>GND</sub>	DC Supply Current per Supply Pin	±100	mA		
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C		
ΤL	Lead Temperature, 1 mm from Cas	se for 10 secs	260	°C	
ТJ	Junction Temperature Under Bias		+150	°C	
$\theta_{JA}$	Thermal Resistance (Note 2)	SC-88A SC-74A SOT-553 SOT-953 UDFN6	377 320 324 254 154	°C/W	
P <sub>D</sub>	Power Dissipation in Still Air	SC-88A SC-74A SOT-553 SOT-953 UDFN6	332 390 386 491 812	mW	
MSL	Moisture Sensitivity		Level 1	-	
F <sub>R</sub>	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	_	
$V_{\text{ESD}}$	ESD Withstand Voltage (Note 3)	Human Body Model Charged Device Model	2000 1000	V	
I <sub>Latchup</sub>	Latchup Performance (Note 4)		±100	mA	

Laterup Exterior Construction (1000 T)
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.
Applicable to devices with outputs that may be tri-stated.
Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace no air flow per JESD51-7.
HBM tested to ANSI/ESDA/JEDEC JS-001-2017. CDM tested to EIA/JESD22-C101-F. JEDEC recommends that ESD qualification to EIA/JESD22-A115-A (Machine Model) be discontinued per JEDEC/JEP172A.
Tested to EIA/JESD78 Class II.

#### **RECOMMENDED OPERATING CONDITIONS**

Symbol	Chara	cteristics	Min	Max	Unit
V <sub>CC</sub>	Positive DC Supply Voltage	1.65	5.5	V	
V <sub>IN</sub>	DC Input Voltage		0	5.5	V
V <sub>OUT</sub>	DC Output Voltage	Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V <sub>CC</sub> = 0 V)	0 0 0	V <sub>CC</sub> 5.5 5.5	
T <sub>A</sub>	Operating Temperature Range		-55	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time SC-88A (NLV)	$V_{CC}$ = 3.0 V to 3.6 V $V_{CC}$ = 4.5 V to 5.5 V	0 0	No Limit No Limit	ns/V
	Input Rise and Fall Time SC-74A, SC-88A, SOT-553, SOT-953, UDFN6	$\begin{array}{c} V_{CC} = 1.65 \ V \ to \ 1.95 \ V \\ V_{CC} = 2.3 \ V \ to \ 2.7 \ V \\ V_{CC} = 3.0 \ V \ to \ 3.6 \ V \\ V_{CC} = 4.5 \ V \ to \ 5.5 \ V \end{array}$	0 0 0 0	No Limit No Limit No Limit No Limit	

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.

#### DC ELECTRICAL CHARACTERISTICS

			V <sub>CC</sub>	Τ,	م = 25°C	;	–55°C ≤ T	<sub>A</sub> ≤ 125°C	
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Units
V <sub>T</sub> +	Positive Input Threshold Voltage		1.65 2.3 2.7 3.0 4.5 5.5	- - - - -	1.0 1.5 1.7 1.9 2.7 3.3	1.4 1.8 2.0 2.2 3.1 3.6	- - - -	1.4 1.8 2.0 2.2 3.1 3.6	V
V <sub>T</sub> -	Negative Input Threshold Voltage		1.65 2.3 2.7 3.0 4.5 5.5	0.2 0.4 0.5 0.6 1.0 1.2	0.5 0.75 0.87 1.0 1.5 1.9		0.2 0.4 0.5 0.6 1.0 1.2	- - - -	V
V <sub>H</sub>	Input Hysteresis Voltage		1.65 2.3 2.7 3.0 4.5 5.5	0.1 0.25 0.3 0.4 0.6 0.7	0.48 0.75 0.83 0.93 1.2 1.4	0.9 1.1 1.15 1.2 1.5 1.7	0.1 0.25 0.3 0.4 0.6 0.7	0.9 1.1 1.15 1.2 1.5 1.7	V
V <sub>OH</sub>	High-Level Output Voltage		1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5	V <sub>CC</sub> - 0.1 1.29 1.9 2.2 2.4 2.3 3.8	V <sub>CC</sub> 1.4 2.1 2.4 2.7 2.5 4.0		V <sub>CC</sub> - 0.1 1.29 1.9 2.2 2.4 2.3 3.8		V
V <sub>OL</sub>	Low–Level Output Voltage		1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5	- - - - - -	0.08 0.2 0.22 0.28 0.38 0.42	0.1 0.24 0.3 0.4 0.4 0.55 0.55		0.1 0.24 0.3 0.4 0.4 0.55 0.55	V
I <sub>IN</sub>	Input Leakage Current	$V_{IN}$ = 5.5 V or GND	1.65 to 5.5	_	-	±0.1	-	±1.0	μA
I <sub>OFF</sub>	Power Off Leakage Current	V <sub>IN</sub> = 5.5 V or V <sub>OUT</sub> = 5.5 V	0	-	-	1.0	-	10	μΑ
ICC	Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5	_	-	1.0	_	10	μΑ

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

#### AC ELECTRICAL CHARACTERISTICS

			V <sub>cc</sub>	T <sub>A</sub> = 25°C		С	–55°C ≤ T		
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Мах	Units
t <sub>PLH</sub> ,	Propagation Delay, A to Y	$R_L$ = 1 MΩ, $C_L$ = 15 pF	1.65 to 1.95	-	9.1	15	-	15.6	ns
t <sub>PHL</sub>	(Figures 3 and 4)	$R_L$ = 1 MΩ, $C_L$ = 15 pF	2.3 to 2.7	-	5.0	9.0	-	9.5	
		$R_L$ = 1 MΩ, $C_L$ = 15 pF	3.0 to 3.6	-	3.7	6.3	-	6.5	
		$R_L = 500 \ \Omega, \ C_L = 50 \ pF$		-	4.4	7.2	-	7.5	
		$R_L$ = 1 MΩ, $C_L$ = 15 pF	4.5 to 5.5	-	3.1	5.2	-	5.5	
		$R_L$ = 500 $\Omega$ , $C_L$ = 50 pF		-	3.7	5.9	-	6.2	

#### **CAPACITIVE CHARACTERISTICS**

Symbol	Parameter	Condition	Typical	Units
C <sub>IN</sub>	Input Capacitance	$V_{CC}$ = 5.5 V, $V_{IN}$ = 0 V or $V_{CC}$	2.5	pF
C <sub>OUT</sub>	Output Capacitance	$V_{CC}$ = 5.5 V, $V_{IN}$ = 0 V or $V_{CC}$	2.5	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)	10 MHz, V <sub>CC</sub> = 3.3 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub> 10 MHz, V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub>	9 11	pF

5.  $C_{PD}$  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:  $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$ .  $C_{PD}$  is used to determine the no–load dynamic power consumption;  $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$ .



Figure 3. Test Circuit

 $R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )

f = 1 MHz

Test	Switch Position	С <sub>L</sub> , pF	$R_{L}, \Omega$	R <sub>1</sub> , Ω		
t <sub>PLH</sub> / t <sub>PHL</sub>	Open	See AC Characteristics Table				
t <sub>PLZ</sub> / t <sub>PZL</sub>	$2 \times V_{CC}$	50	500	500		
t <sub>PHZ</sub> / t <sub>PZH</sub>	GND	50	500	500		

X = Don't Care



Figure 4. Switching Waveforms

		\ \		
V <sub>CC</sub> , V	V <sub>mi</sub> , V	t <sub>PLH</sub> , t <sub>PHL</sub>	t <sub>PZL</sub> , t <sub>PLZ</sub> , t <sub>PZH</sub> , t <sub>PHZ</sub>	V <sub>Y</sub> , V
1.65 to 1.95	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	0.15
2.3 to 2.7	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	0.15
3.0 to 3.6	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	0.3
4.5 to 5.5	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	0.3

#### **DEVICE ORDERING INFORMATION**

Device	Packages	Specific Device Code	Pin 1 Orientation (See below)	Shipping <sup>†</sup>
NL17SZ17DFT2G	SC-88A	LX	Q4	3000 / Tape & Reel
NLV17SZ17DFT2G*	SC-88A	LX	Q4	3000 / Tape & Reel
NL17SZ17DBVT1G	SC-74A	AM	Q4	3000 / Tape & Reel
NL17SZ17XV5T2G	SOT-553	LX	Q4	4000 / Tape & Reel
NL17SZ17P5T5G	SOT-953	J (Rotated 180° CW)	Q2	8000 / Tape & Reel
NL17SZ17MU1TCG (In Development)	UDFN6, 1.45 x 1.0, 0.5P	TBD	Q4	3000 / Tape & Reel
NL17SZ17MU3TCG (In Development)	UDFN6, 1.0 x 1.0, 0.35P	TBD	Q4	3000 / Tape & Reel

+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.

\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

#### Pin 1 Orientation in Tape and Reel



#### PACKAGE DIMENSIONS

SC-88A (SC-70-5/SOT-353) CASE 419A-02 ISSUE L







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.

	INCHES		MILLIMETERS		
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	
ſ	0.004	0.010	0.10	0.25	
Κ	0.004	0.012	0.10	0.30	
Ν	0.008 REF		0.20 REF		
s	0.079	0.087	2.00	2.20	

**SOLDER 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**

#### SC-74A CASE 318BQ **ISSUE B**



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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.

THICKNESS OF BASE MATERIAL.	 

	MILLIMETERS			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	1.55	1.60	1.65	0.061	0.063	0.065
E	1.15	1.20	1.25	0.045	0.047	0.049
е	0.50 BSC			0.020 BSC		
L	0.10	0.20	0.30	0.004	0.008	0.012
HE	1.55	1.60	1.65	0.061	0.063	0.065

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



TOP VIEW





- NOTES:
   1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
   2. CONTROLLING DIMENSION: MILLIMETERS
   3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
   4. 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	
Ш	0.75	0.80	0.85	
е	0.35 BSC			
ΗE	0.95	1.00	1.05	
L	0.175 REF			
L2	0.05	0.10	0.15	
L3			0.15	

#### **SOLDERING FOOTPRINT\***



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#### PACKAGE DIMENSIONS



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