# DUSEU

## **Single Unbuffered Inverter**

## **NL17SZU04**

The NL17SZU04 is a single unbuffered inverter in tiny footprint packages.

#### Features

- Designed for 1.65 V to 5.5 V V<sub>CC</sub> Operation
- 2.1 ns  $t_{PD}$  at  $V_{CC} = 5 V (typ)$
- Input Overvoltage Tolerant up to 5.5 V
- IOFF Supports Partial Power Down Protection
- Source/Sink 24 mA at 3.0 V
- Source/Sink 12 mA at 3.0 V (NLV)
- 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

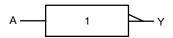
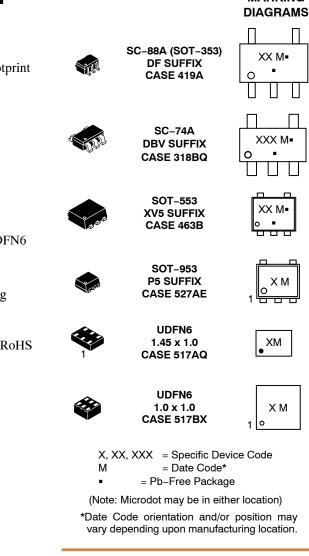


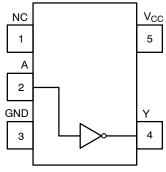
Figure 1. Logic Symbol



#### **ORDERING INFORMATION**

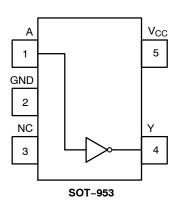
See detailed ordering, marking and shipping information in the package dimensions section on page 7 of this data sheet.

MARKING



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

**PIN ASSIGNMENT** 



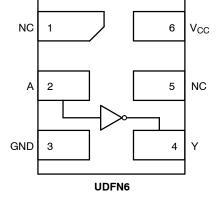


Figure 2. Pinout (Top View)

### PIN ASSIGNMENT (SOT-953)

## (SOT-953) PIN ASSIGNMENT (UDFN)

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

(SC-88A/SOT-553/ TSOP-5/SC-74A)

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

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

#### FUNCTION TABLE

Input	Output Y = Ā
А	Y
L	Н
Н	L

#### MAXIMUM RATINGS

Symbol	Characteristics	Value	Unit
$V_{CC}$	DC Supply Voltage SC-88A (NLV) SC-74A, SC-88A, SOT-953, SOT-553, UDFN6	-0.5 to +7.0 -0.5 to +6.5	V
V <sub>IN</sub>	DC Input Voltage SC-88A (NLV) SC-74A, SC-88A, SOT-953, SOT-553, UDFN6	-0.5 to +7.0 -0.5 to +6.5	V
V <sub>OUT</sub>	DC Output Voltage	–0.5 to V <sub>CC</sub> + 0.5	V
Ι <sub>ΙΚ</sub>	DC Input Diode Current V <sub>IN</sub> < GND	-50	mA
I <sub>OK</sub>	DC Output Diode Current	±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 or Ground Pin	±100	mA
T <sub>STG</sub>	Storage Temperature Range	–65 to +150	°C
ΤL	Lead Temperature, 1 mm from Case for 10 secs	260	°C
TJ	Junction Temperature Under Bias	+150	°C
$\theta_{JA}$	Thermal Resistance (Note 2) SC-88A SOT-553 SOT-953 UDFN6	377 320 324 254 154	°C/W
PD	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

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 10mm-by-1inch, 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.

4. Tested to EIA/JESD78 Class II.

#### **RECOMMENDED OPERATING CONDITIONS**

Symbol	Characteristics			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		0	V <sub>CC</sub>	
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 <sub>CC</sub> = 4.5 V to 5.5 V	0 0	100 20	ns/V
	Input Rise and Fall Time (SC-74A, SC-88A, SOT-953, SOT-553, UDFN6)	$\begin{array}{l} V_{CC} = 1.65 \ V \ to \ 1.95 \ V \\ V_{CC} = 2.3 \ V \ to \ 2.7 \ V \\ V_{CC} = 3.0 \ V \ to \ 3.6 \ V \\ V_{CC} = 4.5 \ V \ to \ 5.5 \ V \end{array}$	0 0 0 0	20 20 10 5	

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

			Vcc	T,	ے = 25°	2	–55°C ≤ T	<sub>A</sub> ≤ 125°C	
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Units
VIH	High-Level Input		1.65 to 1.95	0.85 V <sub>CC</sub>	-	_	0.85 V <sub>CC</sub>	-	V
	Voltage		2.3 to 5.5	0.80 V <sub>CC</sub>	-	_	0.80 V <sub>CC</sub>	_	1
VIL	Low-Level Input		1.65 to 1.95	-	-	0.15 V <sub>CC</sub>	-	0.15 V <sub>CC</sub>	V
	Voltage		2.3 to 5.5	-	-	0.20 V <sub>CC</sub>	_	0.20 V <sub>CC</sub>	1
V <sub>OH</sub>	High-Level Output Voltage (NLV)	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OH} = -100 \ \mu A$	1.65 to 5.5	V <sub>CC</sub> – 0.1	V <sub>CC</sub>	_	V <sub>CC</sub> – 0.1	_	V
			1.65 2.3 2.7 3.0 3.0 4.5	1.29 1.9 2.2 2.4 2.3 3.8	1.52 2.1 2.3 2.6 2.5 4.2	- - - - -	1.29 1.9 2.2 2.4 2.3 3.8	- - - - -	
	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 (NLV)	V <sub>IN</sub> = V <sub>IH</sub> I <sub>OL</sub> = 100 μA	1.65 to 5.5	-	_	0.1	-	0.1	V
			1.65 2.3 2.7 3.0 3.0 4.5		0.08 0.2 0.2 0.24 0.26 0.31	0.24 0.3 0.4 0.4 0.55 0.55		0.24 0.3 0.4 0.4 0.55 0.55	
	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 0.38 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	$V_{IN} = 5.5 \text{ V or GND}$	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	0	-	-	1.0	-	10	μΑ
I <sub>CC</sub>	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.

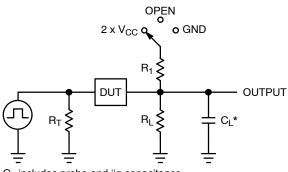
#### AC ELECTRICAL CHARACTERISTICS

			V <sub>cc</sub>	T,	д = 25°	С	–55°C ≤ T	<sub>A</sub> ≤ 125°C	
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Units
t <sub>PLH,</sub>	Propagation Delay, A to Y	$R_L$ = 1 M $\Omega$ , $C_L$ = 15 pF	1.65 to 1.95	-	3.0	11.7	-	12.1	ns
tPHL	(Figures 3 and 4)	$R_L$ = 1 MΩ, $C_L$ = 15 pF	2.3 to 2.7	-	2.2	6.2	-	6.5	
		$R_L$ = 1 MΩ, $C_L$ = 15 pF	3.0 to 3.6	-	2.0	4.5	-	4.8	
		$R_L = 500 \Omega$ , $C_L = 50 pF$		-	2.5	6.0	-	6.6	
		$R_L$ = 1 MΩ, $C_L$ = 15 pF	4.5 to 5.5	-	1.8	3.9	-	4.1	
		$R_L = 500 \ \Omega, \ C_L = 50 \ pF$		_	2.1	5.0	-	5.5	

#### **CAPACITIVE CHARACTERISTICS**

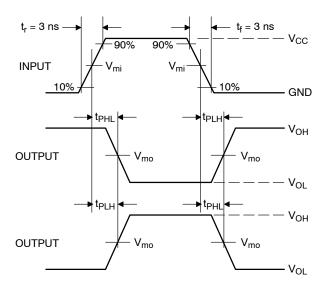
Symbol	Parameter	Condition	Typical	Units
C <sub>IN</sub>	Input Capacitance	$V_{CC}$ = 5.5 V, $V_{IN}$ = 0 V or $V_{CC}$	2.5	pF
C <sub>OUT</sub>	Output Capacitance	$V_{CC}$ = 5.5 V, $V_{IN}$ = 0 V or $V_{CC}$	2.5	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)	10 MHz, V <sub>CC</sub> = 3.3 V,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

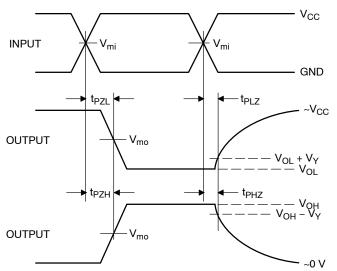
5.  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:  $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$ .  $C_{PD}$  is used to determine the no-load dynamic power consumption;  $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$ .



Switch  $R_L, \Omega$  $R_1, \Omega$ Test  $C_L, pF$ Position t<sub>PLH</sub> / t<sub>PHL</sub> Open See AC Characteristics Table 50 500 500  $2 \times V_{CC}$ t<sub>PLZ</sub> / t<sub>PZL</sub> GND 50 500 500 t<sub>PHZ</sub> / t<sub>PZH</sub> X = Don't Care

### Figure 3. Test Circuit





#### Figure 4. Switching Waveforms

		Vn		
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

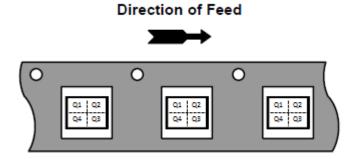
#### **DEVICE ORDERING INFORMATION**

Device	Packages	Marking	Pin 1 Orientation (See below)	Shipping <sup>†</sup>
NL17SZU04DFT2G	SC-88A	L6	Q4	3000 / Tape & Reel
NLV17SZU04DFT2G*	SC-88A	L6	Q4	3000 / Tape & Reel
NL17SZU04DBVT1G	SC-74A	AR	Q4	3000 / Tape & Reel
NL17SZU04XV5T2G	SOT-553	L6	Q4	4000 / Tape & Reel
NL17SZU04P5T5G	SOT-953	6 (Rotated 90° CW)	Q2	8000 / Tape & Reel
NL17SZU04MU1TCG (In Development)	UDFN6, 1.45 x 1.0, 0.5P	TBD	Q4	3000 / Tape & Reel
NL17SZU04MU3TCG (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.

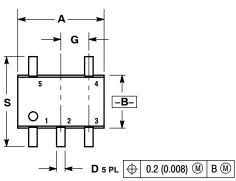
\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

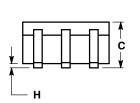
#### Pin 1 Orientation in Tape and Reel

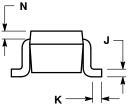


#### PACKAGE DIMENSIONS

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



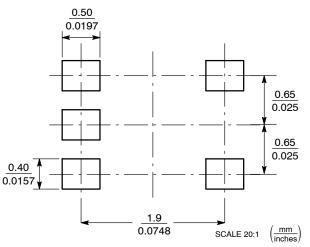




NOTES: 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982. 2. CONTROLLING DIMENSION: INCH. 3. 419A-01 OBSOLETE. NEW STANDARD 419A-02. 4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	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
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

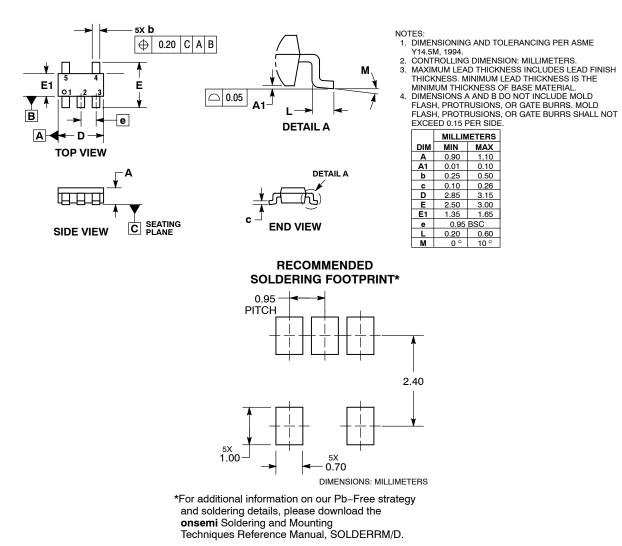
**SOLDER FOOTPRINT\*** 



\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

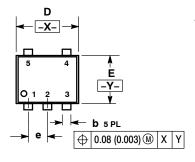
#### PACKAGE DIMENSIONS

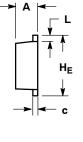
#### SC-74A CASE 318BQ ISSUE B



#### PACKAGE DIMENSIONS

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



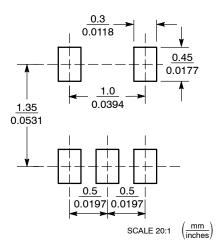


NOTES: 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982. 2. CONTROLLING DIMENSION: MILLIMETERS 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS, MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS, DAOC MEEDING

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

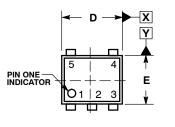
#### **SOLDERING FOOTPRINT\***



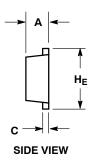
\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

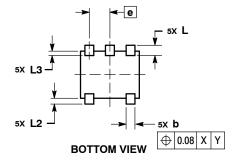
#### PACKAGE DIMENSIONS

SOT-953 CASE 527AE ISSUE E



TOP VIEW

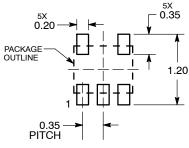




- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS
  3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
  4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	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			
Е	0.75	0.80	0.85			
e	0.35 BSC					
HE	0.95	1.00	1.05			
L	0.175 REF					
L2	0.05	0.10	0.15			
L3			0.15			

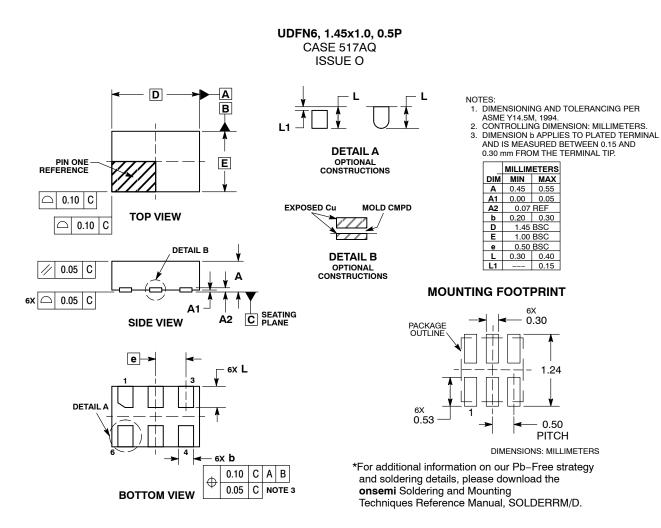
#### **SOLDERING FOOTPRINT\***



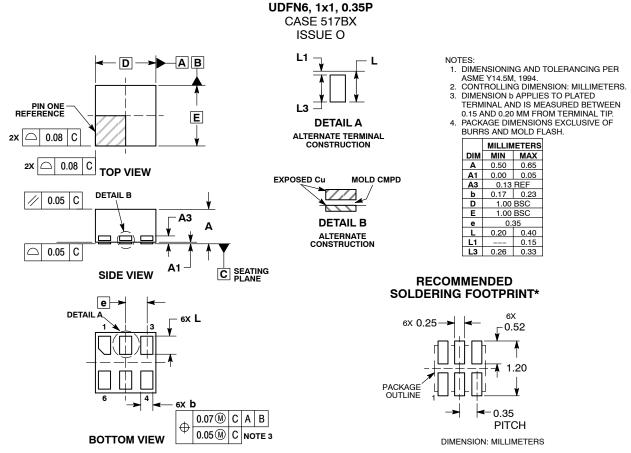
DIMENSIONS: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

#### PACKAGE DIMENSIONS



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#### NL17SZU04