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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_{CC} 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
- 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



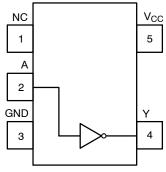
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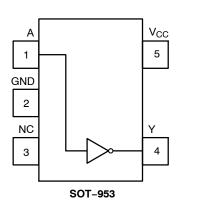
		MARKING DIAGRAMS
ALL	SC–88A (SOT–353) DF SUFFIX CASE 419A	
S. T.	SC-74A DBV SUFFIX CASE 318BQ	XXX M• 0 •
and the second	SOT-553 XV5 SUFFIX CASE 463B	XX M• • •
	SOT-953 P5 SUFFIX CASE 527AE	
1	UDFN6 1.45 x 1.0 CASE 517AQ	● ×W
Ŷ	UDFN6 1.0 x 1.0 CASE 517BX	1 ° X M
X, X M ■	X, XXX = Specific Dev = Date Code* = Pb-Free Package	
*Date C	Microdot may be in eith Code orientation and/or epending upon manufact	position may

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.



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



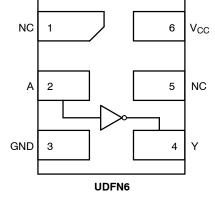


Figure 2. Pinout (Top View)

PIN ASSIGNMENT (SOT-953)

PIN ASSIGNMENT

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

Pin	Function
1	NC
2	A
3	GND
4	Y
5	V _{CC}

Pin	Function
1	А
2	GND
3	NC
4	Y
5	V _{CC}

PIN ASSIGNMENT (UDFN)

Pin	Function		
1	NC		
2	A		
3	GND		
4	Y		
5	NC		
6	V _{CC}		

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 SC-74A, SC-88A, SOT-953, SOT-553, U		V
V _{IN}	DC Input Voltage SC-88A SC-74A, SC-88A, SOT-953, SOT-553, U		V
V _{OUT}	DC Output Voltage	–0.5 to V _{CC} + 0.5	V
I _{IK}	DC Input Diode Current VIN	GND –50	mA
I _{OK}	DC Output Diode Current	±50	mA
I _{OUT}	DC Output Source/Sink Current	±50	mA
I _{CC} or I _{GND}	DC Supply Current per Supply Pin or Ground Pin	±100	mA
T _{STG}	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
θ_{JA}	sc sc sc sc	C-88A 377 C-74A 320 T-553 324 T-953 254 JDFN6 154	°C/W
PD	s sc sc sc	C-88A 332 C-74A 390 T-553 386 T-953 491 JDFN6 812	mW
MSL	Moisture Sensitivity	Level 1	-
F _R	Flammability Rating Oxygen Index: 2	3 to 34 UL 94 V–0 @ 0.125 in	-
V_{ESD}	ESD Withstand Voltage (Note 3) Human Body Charged Device		V
I _{Latchup}	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		Min	Max	Unit
V _{CC}	Positive DC Supply Voltage	1.65	5.5	V	
V _{IN}	DC Input Voltage	0	5.5	V	
V _{OUT}	DC Output Voltage	0	V _{CC}		
T _A	Operating Temperature Range	-55	+125	°C	
t _r , t _f	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	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

			V _{CC}	T,	م = 25°0	C	–55°C ≤ T	A ≤ 125°C	
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Units
VIH	High-Level Input		1.65 to 1.95	0.85 V _{CC}	-	-	0.85 V _{CC}	-	V
	Voltage		2.3 to 5.5	0.80 V _{CC}	-	-	0.80 V _{CC}	-	
VIL	Low-Level Input		1.65 to 1.95	-	-	0.15 V _{CC}	-	0.15 V _{CC}	V
	Voltage		2.3 to 5.5	-	-	0.20 V _{CC}	-	0.20 V _{CC}	
V _{OH}	High-Level Output Voltage		1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5	V _{CC} - 0.1 1.29 1.9 2.2 2.4 2.3 3.8	V _{CC} 1.4 2.1 2.4 2.7 2.5 4.0		V _{CC} - 0.1 1.29 1.9 2.2 2.4 2.3 3.8		V
V _{OL}	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	0.1 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 _{IN}	Input Leakage Current	V _{IN} = 5.5 V or GND	1.65 to 5.5	_	-	±0.1	_	±1.0	μA
I _{OFF}	Power Off Leakage Current	V _{IN} = 5.5 V	0	-	-	1.0	-	10	μA
I _{CC}	Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5	-	-	1.0	-	10	μA

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.

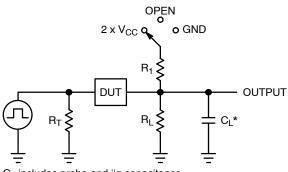
AC ELECTRICAL CHARACTERISTICS

			V _{cc}	T _A = 25°C		–55°C ≤ T			
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Units
t _{PLH,}	t _{PLH,} Propagation Delay, A to Y t _{PHL} (Figures 3 and 4)	R_L = 1 MΩ, C_L = 15 pF	1.65 to 1.95	-	3.0	11.7	-	12.1	ns
PHL		R_L = 1 MΩ, C_L = 15 pF	2.3 to 2.7	-	2.2	6.2	-	6.5	
		R_L = 1 M Ω , C_L = 15 pF	3.0 to 3.6	-	2.0	4.5	-	4.8]
		R_L = 500 Ω , 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 Ω , C_L = 50 pF		_	2.1	5.0	_	5.5	

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Units
C _{IN}	Input Capacitance	V_{CC} = 5.5 V, V_{IN} = 0 V or V_{CC}	2.5	pF
C _{OUT}	Output Capacitance	V_{CC} = 5.5 V, V_{IN} = 0 V or V_{CC}	2.5	pF
C _{PD}	Power Dissipation Capacitance (Note 5)	10 MHz, V_{CC} = 3.3 V, V_{IN} = 0 V or V_{CC} 10 MHz, V_{CC} = 5.5 V, V_{IN} = 0 V or V_{CC}	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; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

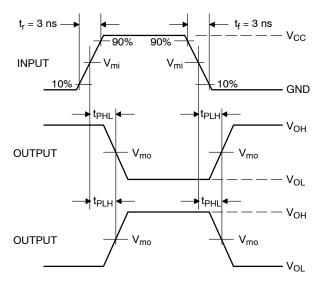


Test	Switch Position	C _L , pF	R_{L}, Ω	R ₁ , Ω
t _{PLH} / t _{PHL}	Open	See AC Character	istics Tal	ole
t _{PLZ} / t _{PZL}	$2 \times V_{CC}$	50	500	500
t _{PHZ} / t _{PZH}	GND	50	500	500

X = Don't Care

 C_L includes probe and jig capacitance R_T is Z_{OUT} of pulse generator (typically 50 $\Omega)$ f = 1 MHz

Figure 3. Test Circuit



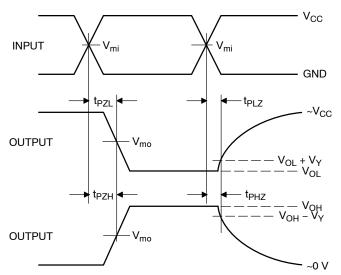


Figure 4. Switching Waveforms

		v		
V _{CC} , V	V _{mi} , V	t _{PLH} , t _{PHL}	t _{PZL} , t _{PLZ} , t _{PZH} , t _{PHZ}	V _Y , V
1.65 to 1.95	V _{CC} / 2	V _{CC} / 2	V _{CC} / 2	0.15
2.3 to 2.7	V _{CC} / 2	V _{CC} / 2	V _{CC} / 2	0.15
3.0 to 3.6	V _{CC} / 2	V _{CC} / 2	V _{CC} / 2	0.3
4.5 to 5.5	V _{CC} / 2	V _{CC} / 2	V _{CC} / 2	0.3

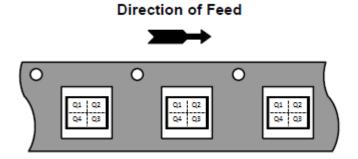
DEVICE ORDERING INFORMATION

Device	Packages	Marking	Pin 1 Orientation (See below)	Shipping [†]
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.

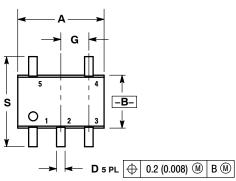
*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

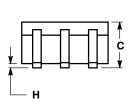
Pin 1 Orientation in Tape and Reel

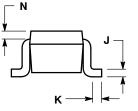


PACKAGE DIMENSIONS

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



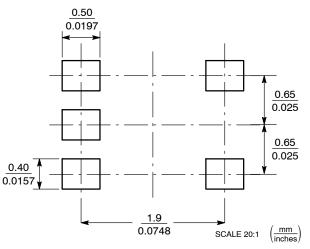




NOTES: 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982. 2. CONTROLLING DIMENSION: INCH. 3. 419A-01 OBSOLETE. NEW STANDARD 419A-02. 4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	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	
J	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	

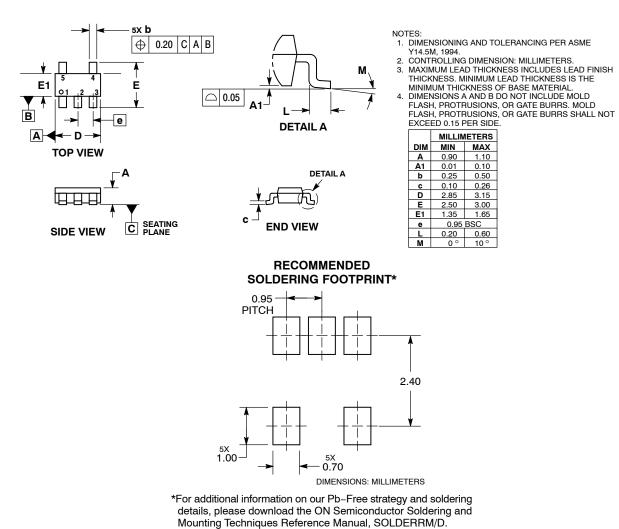
SOLDER FOOTPRINT*



*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

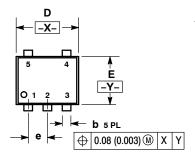
SC-74A CASE 318BQ ISSUE B

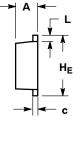


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PACKAGE DIMENSIONS

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



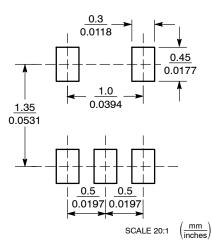


NOTES: 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982. 2. CONTROLLING DIMENSION: MILLIMETERS 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

	NESS 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	

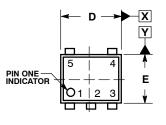
SOLDERING FOOTPRINT*



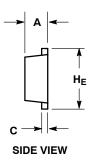
*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

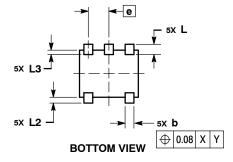
PACKAGE DIMENSIONS

SOT-953 CASE 527AE ISSUE E



TOP VIEW

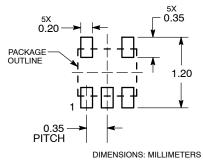




- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: MILLIMETERS
 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
 4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

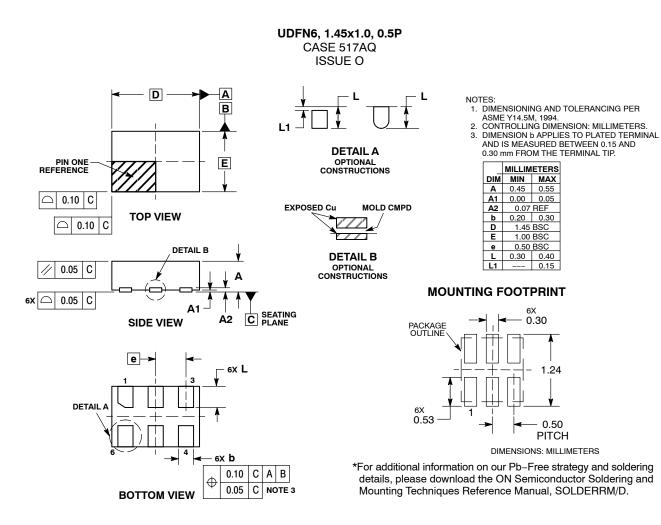
	MILLIMETERS			
DIM	MIN	NOM	MAX	
Α	0.34	0.37	0.40	
b	0.10	0.15	0.20	
С	0.07	0.12	0.17	
D	0.95	1.00	1.05	
E	0.75	0.80	0.85	
е	0.35 BSC			
HE	0.95	1.00	1.05	
L	0.175 REF			
L2	0.05	0.10	0.15	
L3			0.15	

SOLDERING FOOTPRINT*

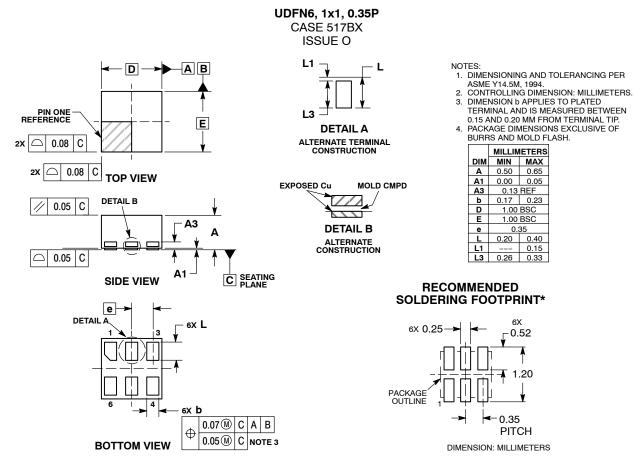


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