## **ON Semiconductor**

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# Single Non-Inverting Buffer with Open Drain Output

### **NL17SZ07**

The NL17SZ07 is a single non-inverting buffer with open drain outputs 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  $V_{CC} = 5 \text{ V (typ)}$
- Input/Output Overvoltage Tolerant up to 5.5 V
- I<sub>OFF</sub> Supports Partial Power Down Protection
- 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

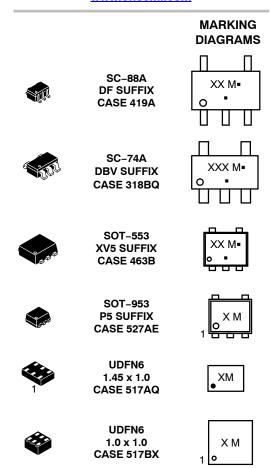


Figure 1. Logic Symbol



#### ON Semiconductor®

#### www.onsemi.com



XX = Specific Device Code

M = Date Code\*
■ Pb-Free Package

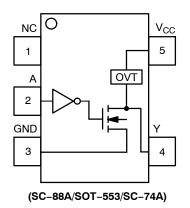
(Note: Microdot may be in either location)

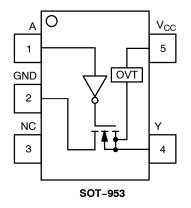
\*Date Code orientation and/or position may vary depending upon manufacturing location.

#### **ORDERING INFORMATION**

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

1





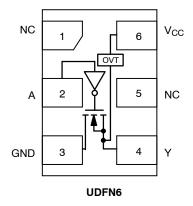


Figure 2. Pinout (Top View)

#### **PIN ASSIGNMENT** (SC-88A/SOT-553/SC-74A)

Pin **Function** 1 NC 2 Α GND 3 Υ 4 5  $V_{\text{CC}}$ 

#### PIN ASSIGNMENT (SOT-953)

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

#### PIN ASSIGNMENT (UDFN)

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

#### **FUNCTION TABLE**

Input	Output
Α	Υ
L	L
Н	Z

#### **MAXIMUM RATINGS**

Symbol	Cha	aracteristics	Value	Unit	
V <sub>CC</sub>	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	
$V_{IN}$	DC Input Voltage SC-	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	٧	
	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)	-0.5 to V <sub>CC</sub> + 0.5 -0.5 to +6.5 -0.5 to +6.5	V	
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < GND	-50	mA	
l <sub>ok</sub>	DC Output Diode Current	-50	mA		
l <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		
TL	Lead Temperature, 1 mm from Cas	260	°C		
$T_J$	Junction Temperature Under Bias		+150	°C	
$ heta_{\sf 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 <sub>ESD</sub>	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.

1. Applicable to devices with outputs that may be tri-stated.

2. Measured with minimum pad spacing on an FR4 board, using 10mm-by-1inch, 2 ounce copper trace no air flow per JESD51-7.

3. 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	Chara	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	Active–Mode (High or Low State) Tri–State Mode (Note 1) Power–Down Mode ( $V_{\rm CC}$ = 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)	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$ $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	0 0	100 20	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	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 <sub>CC</sub>	Τ <sub>Δ</sub>	4 = 25°C		-55°C ≤ T	A ≤ 125°C	
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Units
V <sub>IH</sub>	High-Level Input		1.65 to 1.95	0.65 V <sub>CC</sub>	-	-	0.65 V <sub>CC</sub>	_	V
	Voltage		2.3 to 5.5	0.70 V <sub>CC</sub>	-	-	0.70 V <sub>CC</sub>	-	
$V_{IL}$	Low-Level Input		1.65 to 1.95	-	-	0.35 V <sub>CC</sub>	-	0.35 V <sub>CC</sub>	V
	Voltage		2.3 to 5.5	-	-	0.30 V <sub>CC</sub>	-	0.30 V <sub>CC</sub>	
V <sub>OL</sub>	Low-Level Output Voltage	$\begin{array}{l} V_{IN} = V_{IH} \text{ or } V_{IL} \\ I_{OL} = 100 \ \mu\text{A} \\ I_{OL} = 4 \ \text{mA} \\ I_{OL} = 8 \ \text{mA} \\ I_{OL} = 12 \ \text{mA} \\ I_{OL} = 16 \ \text{mA} \\ I_{OL} = 24 \ \text{mA} \\ I_{OL} = 32 \ \text{mA} \end{array}$	1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5	111111	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 <sub>IN</sub> = 5.5 V or GND	1.65 to 5.5	ı	-	±0.1	=	±1.0	μΑ
l <sub>OZ</sub>	3-State Output Leakage Current	V <sub>OUT</sub> = 0 V to 5.5 V	1.65 to 5.5	ı	ı	±0.5	-	±5.0	μΑ
l <sub>OFF</sub>	Power Off Leakage Current	V <sub>IN</sub> = 5.5 V or V <sub>OUT</sub> = 5.5 V	0	ı	ı	1.0	-	10	μΑ
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	_	_	1.0	-	10	μΑ
I <sub>CCT</sub>	Quiescent Supply Current	V <sub>IN</sub> = 3.0 V	3.6	-	-	10	-	100	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.

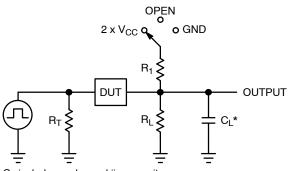
#### **AC ELECTRICAL CHARACTERISTICS**

			V <sub>CC</sub>	T,	<sub>A</sub> = 25°	С	-55°C ≤ T	<sub>A</sub> ≤ 125°C	
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Units
t <sub>PZL</sub>	Propagation Delay, A to Y		1.65 to 1.95	-	6.0	9.0	-	9.5	ns
	(Figures 3 and 4)		2.3 to 2.7	-	3.6	6.1	-	6.5	
			3.0 to 3.6	_	2.7	5.6	_	6.0	
			4.5 to 5.5	-	2.1	4.4	-	4.8	
t <sub>PLZ</sub>	Propagation Delay, A to Y		1.65 to 1.95	-	4.0	9.0	_	9.5	ns
	(Figures 3 and 4)		2.3 to 2.7	-	2.8	6.1	-	6.5	
			3.0 to 3.6	-	2.5	5.6	_	6.0	
			4.5 to 5.5		2.2	4.4	-	4.8	

#### **CAPACITIVE CHARACTERISTICS**

Symbol	Parameter	Condition	Typical	Units
C <sub>IN</sub>	Input Capacitance	$V_{CC} = 5.5 \text{ V}, V_{IN} = 0 \text{ V or } V_{CC}$	2.5	pF
C <sub>OUT</sub>	Output Capacitance	$V_{CC}$ = 5.5 V, $V_{IN}$ = 0 V or $V_{CC}$	4.0	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 5)	10 MHz, $V_{CC}$ = 5.5 V, $V_{IN}$ = 0 V or $V_{CC}$	4.0	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>.



Test	Switch Position	C <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 x V <sub>CC</sub>	50	500	500	
t <sub>PHZ</sub> / t <sub>PZH</sub>	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

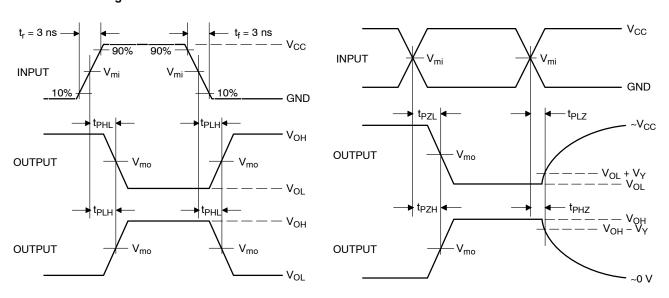


Figure 4. Switching Waveforms

		V <sub>m</sub>		
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>
NL17SZ07DFT2G	SC-88A	L7	Q4	3000 / Tape & Reel
NLV17SZ07DFT2G*	SC-88A	L7	Q4	3000 / Tape & Reel
NL17SZ07DBVT1G	SC-74A	AG	Q4	3000 / Tape & Reel
NL17SZ07XV5T2G	SOT-553	L7	Q4	4000 / Tape & Reel
NL17SZ07P5T5G	SOT-953	D (Rotated 180° CW)	Q2	8000 / Tape & Reel
NL17SZ07MU1TCG (In Development)	UDFN6, 1.45 x 1.0 x 0.35P	TBD	Q4	3000 / Tape & Reel
NL17SZ07MU3TCG (In Development)	UDFN6, 1.0 x 1.0 x 0.35P	TBD	Q4	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.

#### Pin 1 Orientation in Tape and Reel

#### Direction of Feed



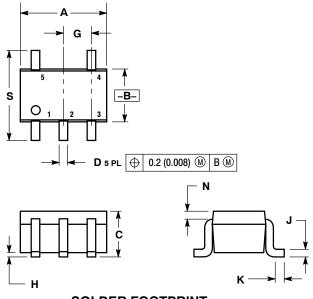


PACKAGE DIMENSIONS

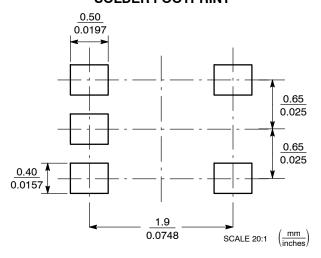
<sup>\*</sup>NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

#### **PACKAGE DIMENSIONS**

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



#### **SOLDER FOOTPRINT**

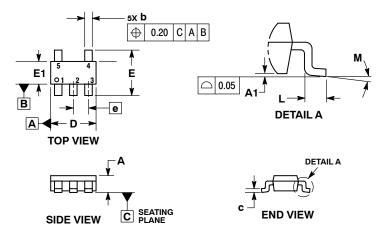


- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
  4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	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	

#### **PACKAGE DIMENSIONS**

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



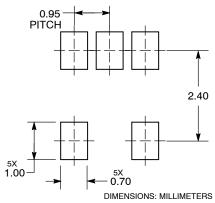
#### NOTES:

- NOTES:

  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
  4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEPT 0.15 PER SIDE EXCEED 0.15 PER SIDE.

	MILLIMETERS		
DIM	MIN	MAX	
Α	0.90	1.10	
A1	0.01	0.10	
b	0.25	5 0.50	
С	0.10	0.26	
D	2.85	3.15	
E	2.50	3.00	
E1	1.35	1.65	
е	0.95 BSC		
L	0.20	0.60	
М	0° 10°		

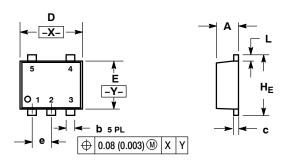
#### **RECOMMENDED SOLDERING FOOTPRINT\***



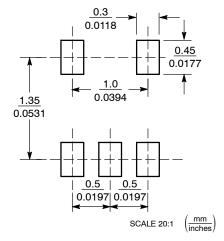
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

#### **PACKAGE DIMENSIONS**

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



## RECOMMENDED SOLDERING FOOTPRINT\*



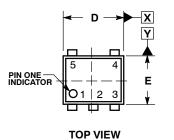
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

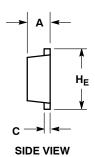
- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETERS
  3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH
  THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM
  THICKNESS OF BASE MATERIAL.

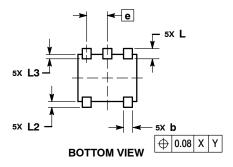
	MILLIMETERS		INCHES			
DIM	MIN	NOM	MAX	MIN	NOM	MAX
Α	0.50	0.55	0.60	0.020	0.022	0.024
b	0.17	0.22	0.27	0.007	0.009	0.011
С	0.08	0.13	0.18	0.003	0.005	0.007
D	1.55	1.60	1.65	0.061	0.063	0.065
E	1.15	1.20	1.25	0.045	0.047	0.049
е		0.50 BSC			0.020 BSC	
L	0.10	0.20	0.30	0.004	0.008	0.012
HE	1.55	1.60	1.65	0.061	0.063	0.065

#### **PACKAGE DIMENSIONS**

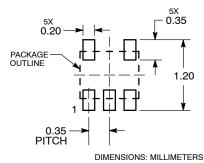
SOT-953 CASE 527AE ISSUE E







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



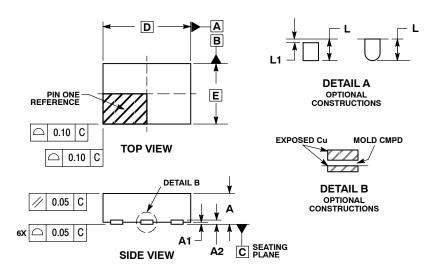
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ASME
- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
   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
O	0.07	0.12	0.17
D	0.95	1.00	1.05
Е	0.75	0.80	0.85
е	0.35 BSC		
HΕ	0.95	1.00	1.05
٦	0.175 REF		
L2	0.05	0.10	0.15
L3			0.15

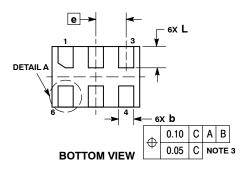
#### **PACKAGE DIMENSIONS**

#### UDFN6, 1.45x1.0, 0.5P CASE 517AQ ISSUE O

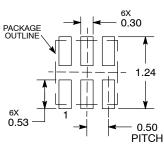


- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP.

	MILLIMETERS		
DIM	MIN	MAX	
Α	0.45	0.55	
A1	0.00 0.05		
A2	0.07 REF		
b	0.20	0.30	
D	1.45 BSC		
Е	1.00 BSC		
е	0.50 BSC		
L	0.30	0.40	
L1		0.15	



#### **MOUNTING FOOTPRINT**

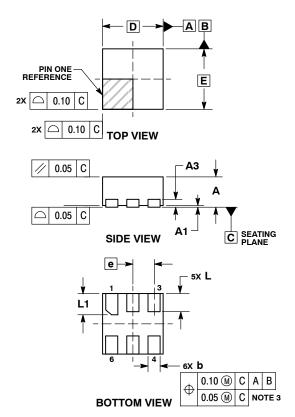


DIMENSIONS: MILLIMETERS

<sup>\*</sup>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

UDFN6, 1x1, 0.35P CASE 517BX **ISSUE O** 

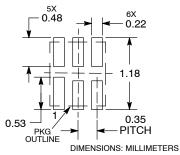


#### NOTES

- DIMENSIONING AND TOLERANCING PER
- ASME Y14.5M, 1994.
  CONTROLLING DIMENSION: MILLIMETERS.
  DIMENSION 6 APPLIES TO PLATED
  TERMINAL AND IS MEASURED BETWEEN
- 0.15 AND 0.20 MM FROM TERMINAL TIP. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

	MILLIMETERS		
DIM	MIN MAX		
Α	0.45 0.5		
A1	0.00	0.05	
А3	0.13 REF		
b	0.12	0.22	
D	1.00 BSC		
E	1.00 BSC		
е	0.35 BSC		
L	0.25	0.35	
L1	0.30	0.40	

#### RECOMMENDED **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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