

Single Non-Inverting Buffer with Schmitt Trigger

NL17SZ17

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

Features

- 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
- I_{OFF} 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

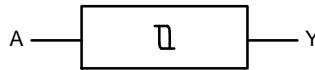
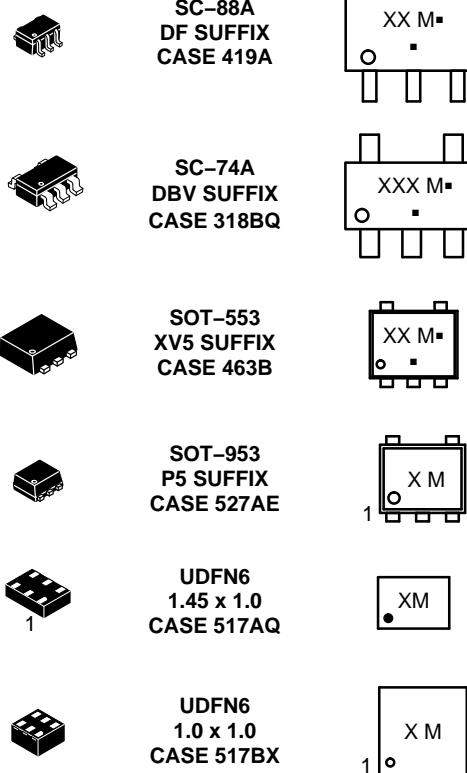


Figure 1. Logic Symbol

MARKING DIAGRAMS



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 8 of this data sheet.

NL17SZ17

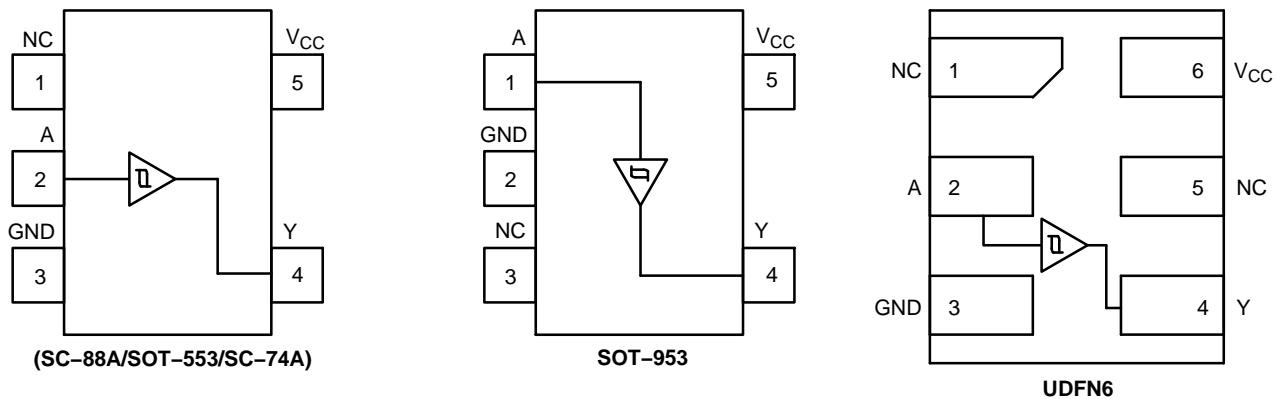


Figure 2. Pinout (Top View)

PIN ASSIGNMENT

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

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

PIN ASSIGNMENT (SOT-953)

Pin	Function
1	A
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
A	Y
L	L
H	H

MAXIMUM RATINGS

Symbol	Characteristics	Value	Unit
V _{CC}	DC Supply Voltage SC-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-74A, SC-88A, SOT-553, SOT-953, UDFN6	-0.5 to +7.0 -0.5 to +6.5	V
V _{OUT}	DC Output Voltage SC-88A (NLV) Active–Mode (High or Low State) Tri–State Mode (Note 1) Power–Down Mode (V _{CC} = 0 V)	-0.5 to V _{CC} + 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 _{CC} = 0 V)	-0.5 to V _{CC} + 0.5 -0.5 to +6.5 -0.5 to +6.5	V
I _{IK}	DC Input Diode Current V _{IN} < GND	-50	mA
I _{OK}	DC Output Diode Current V _{OUT} < GND	-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
T _L	Lead Temperature, 1 mm from Case for 10 secs	260	°C
T _J	Junction Temperature Under Bias	+150	°C
θ _{JA}	Thermal Resistance (Note 2) SC-88A SC-74A SOT-553 SOT-953 UDFN6	377 320 324 254 154	°C/W
P _D	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 _R	Flammability Rating Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	—
V _{ESD}	ESD Withstand Voltage (Note 3) Human Body Model Charged Device Model	2000 1000	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 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.

NL17SZ17

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 Active–Mode (High or Low State) Tri–State Mode (Note 1) Power–Down Mode ($V_{CC} = 0$ V)	0 0 0	V_{CC} 5.5 5.5	
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	No Limit No Limit
	Input Rise and Fall Time SC-74A, SC-88A, SOT-553, SOT-953, UDFN6	$V_{CC} = 1.65$ 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	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

Symbol	Parameter	Condition	V _{CC} (V)	T _A = 25°C			-55°C ≤ T _A ≤ 125°C		Units
				Min	Typ	Max	Min	Max	
V _{T+}	Positive Input Threshold Voltage (NLV)		1.65	0.6	1.0	1.4	0.6	1.4	V
			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	
	Positive Input Threshold Voltage		1.65	—	1.0	1.4	—	1.4	V
			2.3	—	1.5	1.8	—	1.8	
			2.7	—	1.7	2.0	—	2.0	
			3.0	—	1.9	2.2	—	2.2	
			4.5	—	2.7	3.1	—	3.1	
			5.5	—	3.3	3.6	—	3.6	
V _{T-}	Negative Input Threshold Voltage (NLV)		1.65	0.2	0.5	0.8	0.2	0.8	V
			2.3	0.4	0.75	1.15	0.4	1.15	
			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	
			5.5	1.2	1.9	2.3	1.2	2.3	
	Negative Input Threshold Voltage		1.65	0.2	0.5	—	0.2	—	V
			2.3	0.4	0.75	—	0.4	—	
			2.7	0.5	0.87	—	0.5	—	
			3.0	0.6	1.0	—	0.6	—	
			4.5	1.0	1.5	—	1.0	—	
			5.5	1.2	1.9	—	1.2	—	
V _H	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 _{OH}	High-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OH} = -100 µA I _{OH} = -4 mA I _{OH} = -8 mA I _{OH} = -12 mA I _{OH} = -16 mA I _{OH} = -24 mA I _{OH} = -32 mA	1.65 to 5.5	V _{CC} - 0.1 1.65 1.65 1.65 1.65 1.65 1.65 1.65	V _{CC} 1.29 1.4 — — — — — —	— — — — — — — — —	V _{CC} - 0.1 1.29 1.9 2.2 2.4 2.7 2.3 3.8	— — — — — — — —	V
V _{OL}	Low-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OL} = 100 µA I _{OL} = 4 mA I _{OL} = 8 mA I _{OL} = 12 mA I _{OL} = 16 mA I _{OL} = 24 mA I _{OL} = 32 mA	1.65 to 5.5	— 1.65 1.65 1.65 1.65 1.65 1.65 1.65	0.08 0.2 0.22 0.28 0.38 0.42	0.1 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 or V _{OUT} = 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.

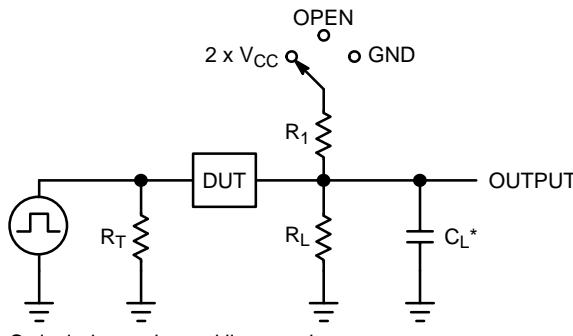
AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V _{CC} (V)	T _A = 25°C			-55°C ≤ T _A ≤ 125°C		Units
				Min	Typ	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation Delay, A to Y (Figures 3 and 4)	R _L = 1 MΩ, C _L = 15 pF	1.65 to 1.95	–	9.1	15	–	15.6	ns
		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 Ω, 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 Ω, C _L = 50 pF		–	3.7	5.9	–	6.2	

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} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.



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

Figure 3. Test Circuit

Test	Switch Position	C _L , pF	R _L , Ω	R ₁ , Ω
t _{PLH} / t _{PHL}	Open	See AC Characteristics Table		
t _{PLZ} / t _{PZL}	2 × V _{CC}	50	500	500
t _{PHZ} / t _{PZH}	GND	50	500	500

X = Don't Care

NL17SZ17

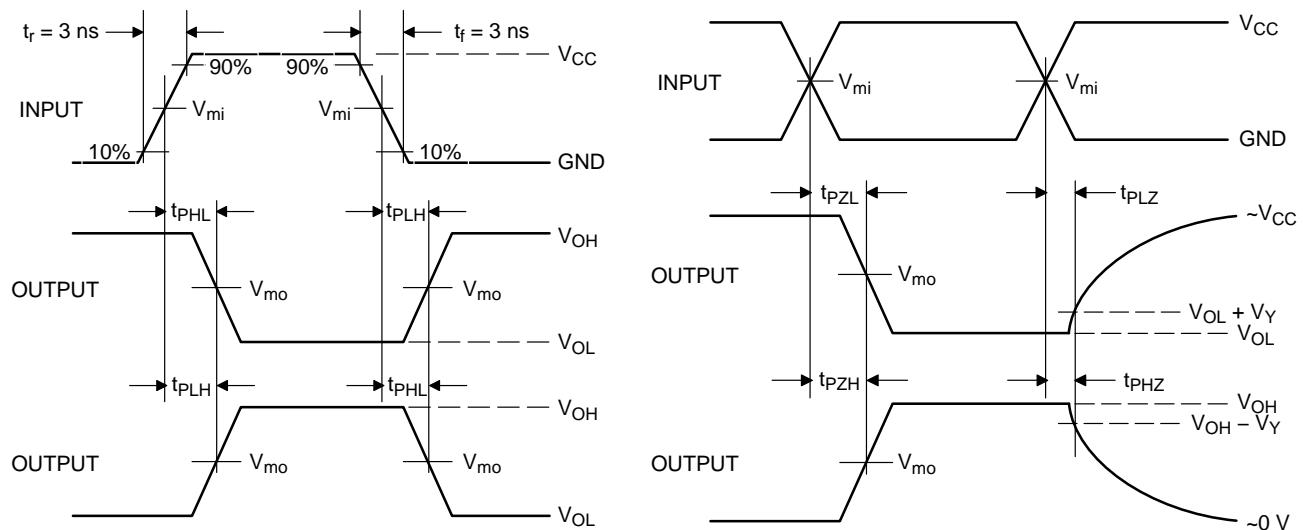


Figure 4. Switching Waveforms

V _{CC} , V	V _{mi} , V	V _{mo} , V		V _Y , V
		t _{PLH} , t _{PHL}	t _{PZL} , t _{PLZ} , t _{PZH} , t _{PHZ}	
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

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DEVICE ORDERING INFORMATION

Device	Packages	Specific Device Code	Pin 1 Orientation (See below)	Shipping [†]
NL17SZ17DFT2G	SC-88A	LX	Q4	3000 / Tape & Reel
NLV17SZ17DFT2G*	SC-88A	LX	Q4	3000 / Tape & Reel
NL17SZ17DFT2G-F22038**	SC-88A	LX	Q4	3000 / Tape & Reel
NL17SZ17DBVT1G	SC-74A	AM	Q4	3000 / Tape & Reel
NL17SZ17XV5T2G	SOT-553	LX	Q4	4000 / Tape & Reel
NL17SZ17XV5T2G-L22087**	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

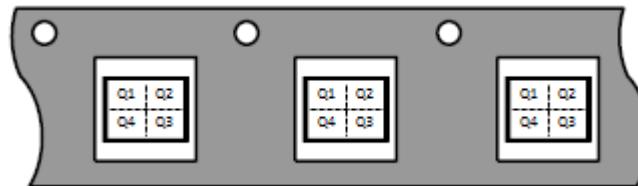
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

**Please refer to NLV specifications for this device.

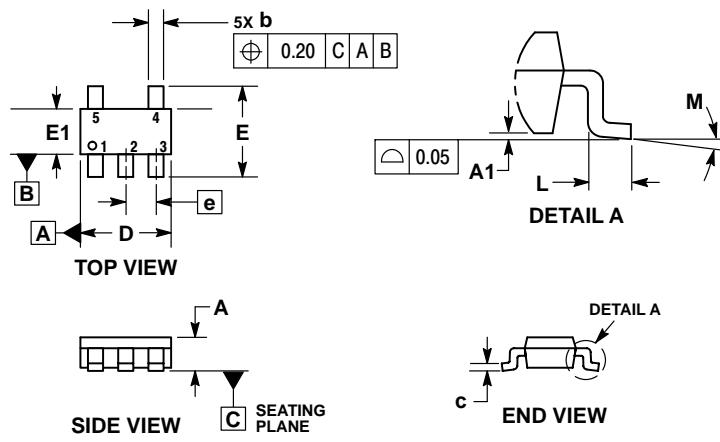
Pin 1 Orientation in Tape and Reel

Direction of Feed



PACKAGE DIMENSIONS

SC-74A
CASE 318BQ
ISSUE B

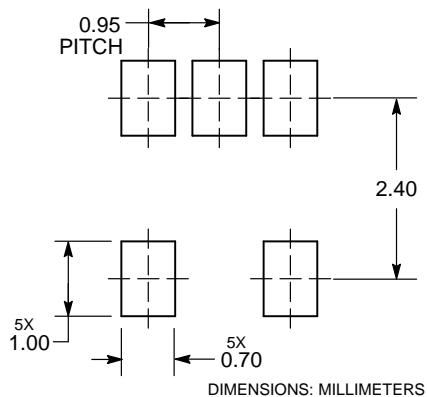


NOTES:

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 EXCEED 0.15 PER SIDE.

DIM	MILLIMETERS	
	MIN	MAX
A	0.90	1.10
A1	0.01	0.10
b	0.25	0.50
c	0.10	0.26
D	2.85	3.15
E	2.50	3.00
E1	1.35	1.65
e	0.95 BSC	
L	0.20	0.60
M	0 °	10 °

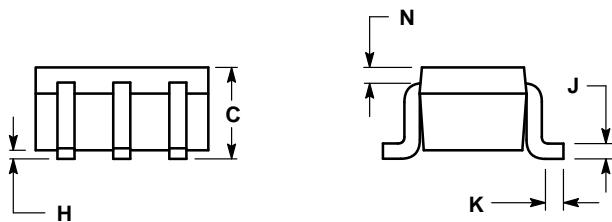
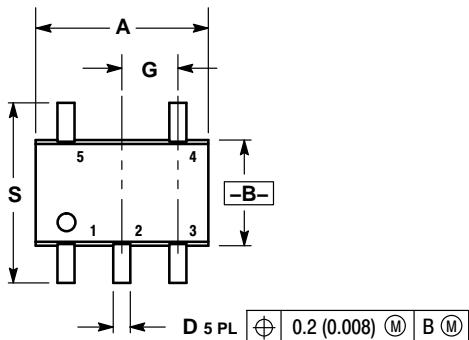
RECOMMENDED SOLDERING FOOTPRINT*



*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

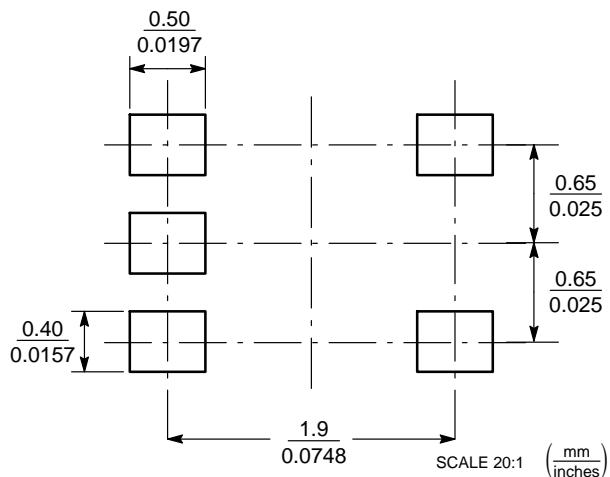
SC-88A (SC-70-5/SOT-353)
CASE 419A-02
ISSUE L



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.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC	0.065 BSC		
H	---	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

SOLDER FOOTPRINT



STYLE 1:
PIN 1. BASE
2. Emitter
3. BASE
4. COLLECTOR
5. COLLECTOR

STYLE 2:
PIN 1. ANODE
2. Emitter
3. BASE
4. COLLECTOR
5. CATHODE

STYLE 3:
PIN 1. ANODE 1
2. N/C
3. ANODE 2
4. CATHODE 2
5. CATHODE 1

STYLE 4:
PIN 1. SOURCE 1
2. DRAIN 1/2
3. SOURCE 1
4. GATE 1
5. GATE 2

STYLE 5:
PIN 1. CATHODE
2. COMMON ANODE
3. CATHODE 2
4. CATHODE 3
5. CATHODE 4

STYLE 6:
PIN 1. Emitter 2
2. BASE 2
3. Emitter 1
4. COLLECTOR
5. COLLECTOR 2/BASE 1

STYLE 7:
PIN 1. BASE
2. Emitter
3. BASE
4. COLLECTOR
5. COLLECTOR

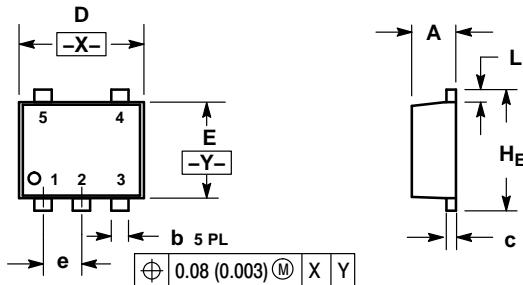
STYLE 8:
PIN 1. CATHODE
2. COLLECTOR
3. N/C
4. BASE
5. Emitter

STYLE 9:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. ANODE
5. ANODE

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

PACKAGE DIMENSIONS

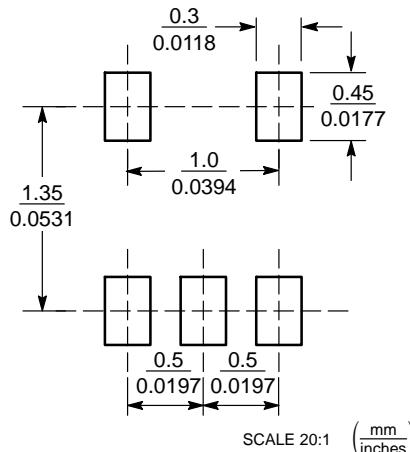
**SOT-553, 5 LEAD
CASE 463B
ISSUE C**



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.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	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
c	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
e	0.50 BSC			0.020 BSC		
L	0.10	0.20	0.30	0.004	0.008	0.012
H _E	1.55	1.60	1.65	0.061	0.063	0.065

**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.

STYLE 1:

- PIN 1. BASE
- 2. Emitter
- 3. Base
- 4. Collector
- 5. Collector

STYLE 6:

- PIN 1. Emitter 2
- 2. Base 2
- 3. Emitter 1
- 4. Collector 1
- 5. Collector 2/Base 1

STYLE 2:

- PIN 1. Cathode
- 2. Common Anode
- 3. Cathode 2
- 4. Cathode 3
- 5. Cathode 4

STYLE 7:

- PIN 1. Base
- 2. Emitter
- 3. Base
- 4. Collector
- 5. Collector

STYLE 3:

- PIN 1. Anode 1
- 2. N/C
- 3. Anode 2
- 4. Cathode 2
- 5. Cathode 1

STYLE 8:

- PIN 1. Cathode
- 2. Collector
- 3. N/C
- 4. Base
- 5. Collector

STYLE 4:

- PIN 1. Source 1
- 2. Drain 1/2
- 3. Source 1
- 4. Gate 1
- 5. Gate 2

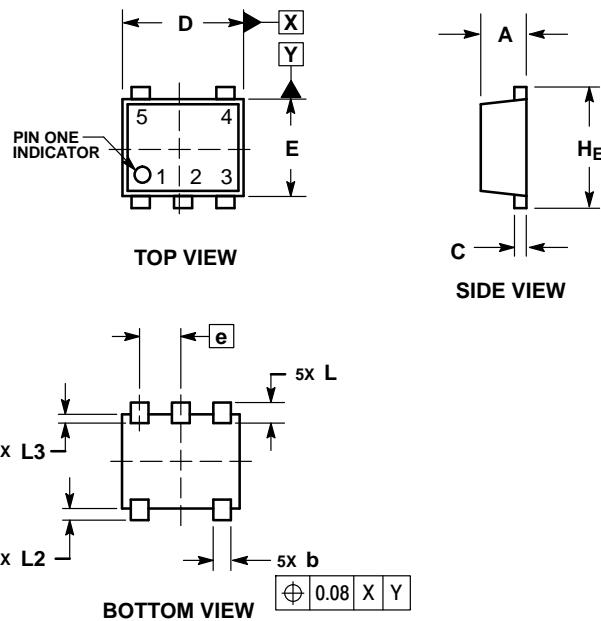
STYLE 9:

- PIN 1. Anode
- 2. Emitter
- 3. Base
- 4. Collector
- 5. Cathode

STYLE 5:

- PIN 1. Anode
- 2. Emitter
- 3. Base
- 4. Collector
- 5. Cathode

PACKAGE DIMENSIONS

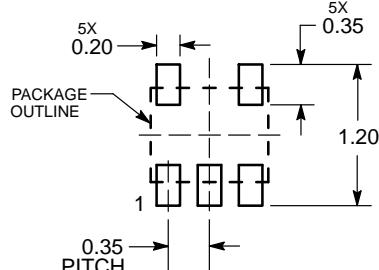
SOT-953
CASE 527AE
ISSUE E

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.

DIM.	MILLIMETERS		
	MIN	NOM.	MAX
A	0.34	0.37	0.40
b	0.10	0.15	0.20
C	0.07	0.12	0.17
D	0.95	1.00	1.05
E	0.75	0.80	0.85
e	0.35 BSC		
H _E	0.95	1.00	1.05
L	0.175 REF		
L ₂	0.05	0.10	0.15
L ₃	---	---	0.15

SOLDERING FOOTPRINT*

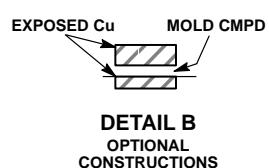
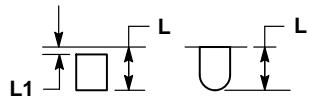
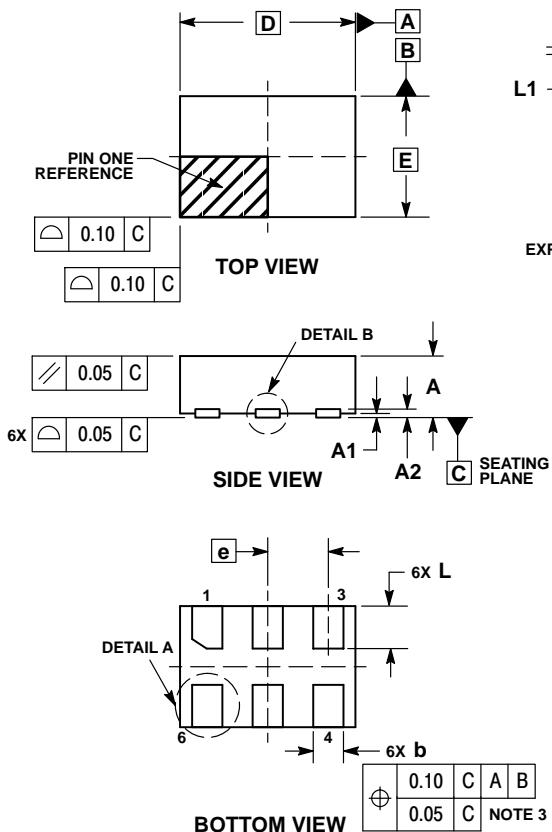


DIMENSIONS: MILLIMETERS

*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

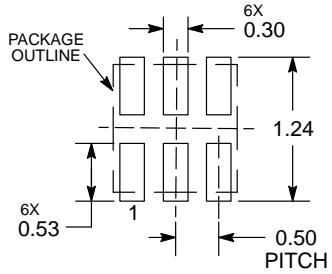
UDFN6, 1.45x1.0, 0.5P
CASE 517AQ
ISSUE O



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.

DIM	MILLIMETERS	
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A2	0.07	REF
b	0.20	0.30
D	1.45	BSC
E	1.00	BSC
e	0.50	BSC
L	0.30	0.40
L1	—	0.15

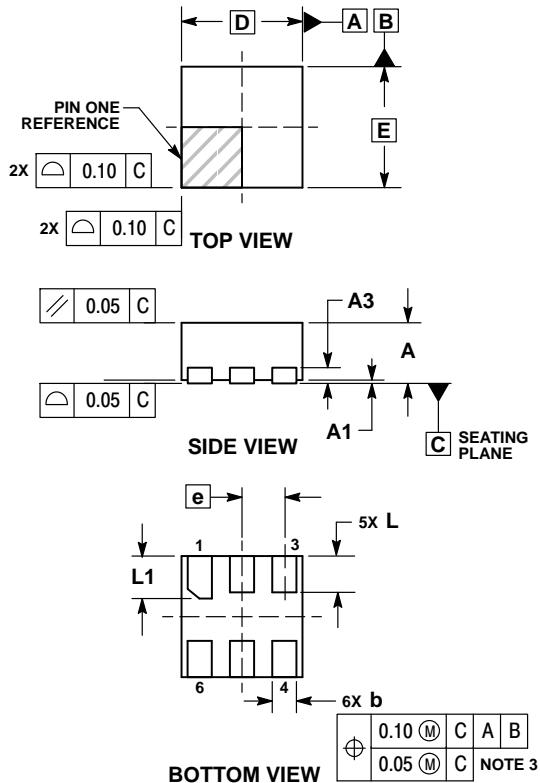
MOUNTING FOOTPRINT

DIMENSIONS: MILLIMETERS

*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

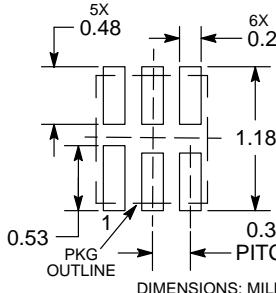
UDFN6, 1x1, 0.35P
CASE 517BX
ISSUE O



NOTES:

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 0.20 MM FROM TERMINAL TIP.
4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

MILLIMETERS		
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13 REF	
b	0.12	0.22
D	1.00 BSC	
E	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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