

# Single 2-Input Exclusive-OR Gate

## NL17SZ86

The NL17SZ86 is a high performance single 2-input Exclusive-OR Gate in tiny footprint packages.

### Features

- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation
- 2.9 ns  $t_{PD}$  at  $V_{CC} = 5$  V (typ)
- Inputs/Outputs 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

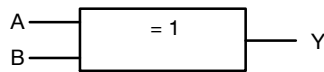
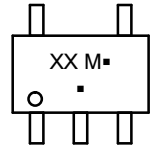


Figure 1. Logic Symbol

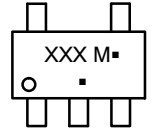
### MARKING DIAGRAMS



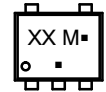
SC-88A  
DF SUFFIX  
CASE 419A



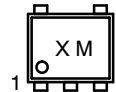
SC-74A  
DBV SUFFIX  
CASE 318BQ



SOT-553  
XV5 SUFFIX  
CASE 463B



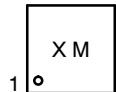
SOT-953  
P5 SUFFIX  
CASE 527AE



UDFN6  
1.45 x 1.0  
CASE 517AQ



UDFN6  
1.0 x 1.0  
CASE 517BX



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.

# NL17SZ86

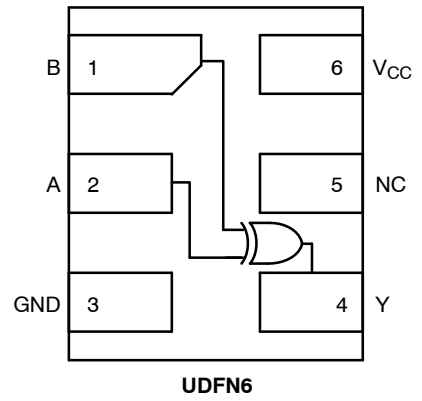
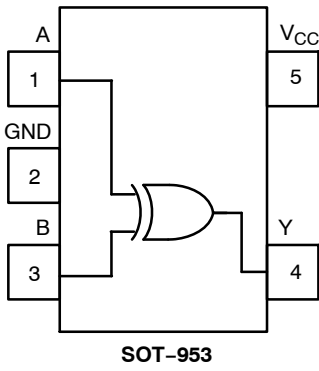
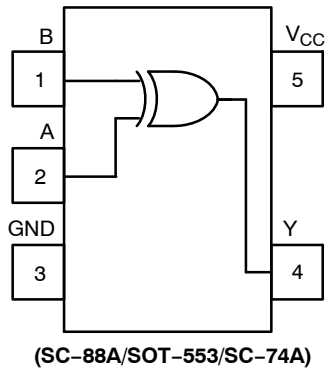


Figure 2. Pinout (Top View)

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

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

## PIN ASSIGNMENT (SOT-953)

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

## PIN ASSIGNMENT (UDFN)

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

## FUNCTION TABLE

Input		Output
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

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## MAXIMUM RATINGS

Symbol	Characteristics	Value	Unit	
V <sub>CC</sub>	DC Supply Voltage (NLV)	-0.5 to +7.0 -0.5 to +6.5	V	
V <sub>IN</sub>	DC Input Voltage (NLV)	-0.5 to +7.0 -0.5 to +6.5	V	
V <sub>OUT</sub>	DC Output Voltage (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 (NL17SZ86P5T5G-L22088 Only)	-0.5 to V <sub>CC</sub> + 0.5		
	DC Output Voltage (NL17SZ86P5T5G-L22088 Only) 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		
I <sub>IK</sub>	DC Input Diode Current V <sub>IN</sub> < GND	-50	mA	
I <sub>OK</sub>	DC Output Diode Current V <sub>OUT</sub> < GND	-50	mA	
	DC Output Diode Current (NL17SZ86P5T5G-L22088 Only)	±50		
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	
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 secs	260	°C	
T <sub>J</sub>	Junction Temperature Under Bias	+150	°C	
θ <sub>JA</sub>	Thermal Resistance (Note 2)	SC-88A	377	°C/W
		SC-74A	320	
		SOT-553	324	
		SOT-953	254	
		UDFN6	154	
P <sub>D</sub>	Power Dissipation in Still Air	SC-88A	332	mW
		SC-74A	390	
		SOT-553	386	
		SOT-953	491	
		UDFN6	812	
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	V	
		1000		
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.

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## 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	V
	DC Output Voltage	(NL17SZ86P5T5G-L22088 Only)	0	$V_{CC}$	
$T_A$	Operating Temperature Range	-55	+125	°C	
$t_r, t_f$	Input Rise and Fall Time (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	$V_{CC} = 1.65$ 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	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

Symbol	Parameter	Condition	$V_{CC}$ (V)	$T_A = 25^\circ\text{C}$			$-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		Units
				Min	Typ	Max	Min	Max	
$V_{IH}$	High-Level Input Voltage (NLV and NL17SZ86P5T5G-L22088)		1.65 to 1.95	$0.75 \times V_{CC}$	-	-	$0.75 \times V_{CC}$	-	V
			2.3 to 5.5	$0.70 \times V_{CC}$	-	-	$0.70 \times V_{CC}$	-	
$V_{IH}$	High-Level Input Voltage		1.65 to 1.95	$0.65 \times V_{CC}$	-	-	$0.65 \times V_{CC}$	-	V
			2.3 to 5.5	$0.70 \times V_{CC}$	-	-	$0.70 \times V_{CC}$	-	
$V_{IL}$	Low-Level Input Voltage (NLV and NL17SZ86P5T5G-L22088)		1.65 to 1.95	-	-	$0.25 \times V_{CC}$	-	$0.25 \times V_{CC}$	V
			2.3 to 5.5	-	-	$0.30 \times V_{CC}$	-	$0.30 \times V_{CC}$	
$V_{IL}$	Low-Level Input Voltage		1.65 to 1.95	-	-	$0.35 \times V_{CC}$	-	$0.35 \times V_{CC}$	V
			2.3 to 5.5	-	-	$0.30 \times V_{CC}$	-	$0.30 \times V_{CC}$	
$V_{OH}$	High-Level Output Voltage	$V_{IN} = V_{IH}$ or $V_{IL}$ $I_{OH} = -100 \mu\text{A}$ $I_{OH} = -4$ 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 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	$V_{IN} = V_{IH}$ or $V_{IL}$ $I_{OL} = 100 \mu\text{A}$ $I_{OL} = 4$ 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 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
$I_{IN}$	Input Leakage Current	$V_{IN} = 5.5$ V or GND	1.65 to 5.5	-	-	$\pm 0.1$	-	$\pm 1.0$	$\mu\text{A}$
$I_{OFF}$	Power Off Leakage Current	$V_{IN} = 5.5$ V or $V_{OUT} = 5.5$ V	0	-	-	1.0	-	10	$\mu\text{A}$
	Power Off Leakage Current (NL17SZ86P5T5G-L22088 Only)	$V_{IN} = 5.5$ V	0	-	-	1.0	-	10	$\mu\text{A}$
$I_{CC}$	Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5	-	-	1.0	-	10	$\mu\text{A}$

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.

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## AC ELECTRICAL CHARACTERISTICS

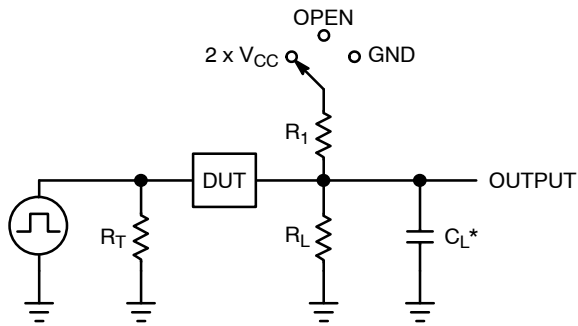
Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			-55°C ≤ T <sub>A</sub> ≤ 125°C		Units
				Min	Typ	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, (A or B) to Y (Figures 3 and 4)	R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF	1.65 to 1.95	-	6.9	13.8	-	14.5	ns
		R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF	2.3 to 2.7	-	4.1	7.0	-	7.5	
		R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF	3.0 to 3.6	-	3.0	4.8	-	5.2	
				-	3.8	5.4	-	5.9	
		R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF	4.5 to 5.5	-	2.2	3.5	-	3.8	
		R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF		-	2.9	4.2	-	4.6	

## CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Units
C <sub>IN</sub>	Input Capacitance	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub>	2.5	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub>	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>	9	pF
		10 MHz, V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub>	11	

5. 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>.

# NL17SZ86

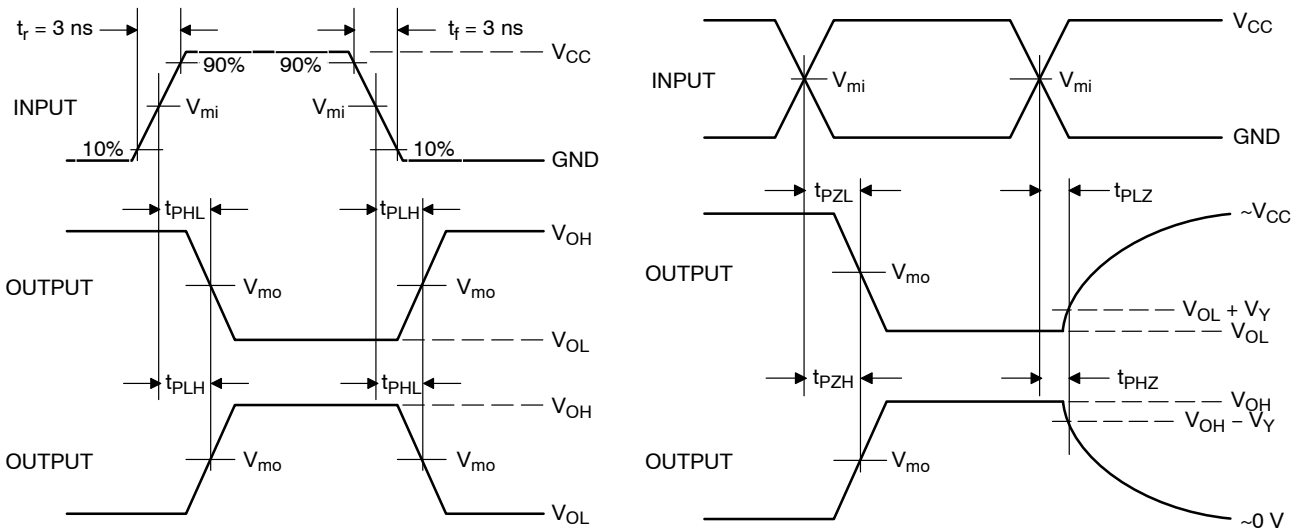


$C_L$  includes probe and jig capacitance  
 $R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )  
 $f = 1$  MHz

**Figure 3. Test Circuit**

Test	Switch Position	$C_L$ , pF	$R_L$ , $\Omega$	$R_1$ , $\Omega$
$t_{PLH} / t_{PHL}$	Open	See AC Characteristics Table		
$t_{PLZ} / t_{PZL}$	$2 \times V_{CC}$	50	500	500
$t_{PHZ} / t_{PZH}$	GND	50	500	500

X = Don't Care



**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

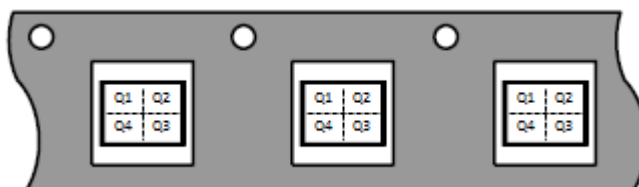
Device	Packages	Specific Device Code	Pin 1 Orientation (See below)	Shipping <sup>†</sup>
NL17SZ86DFT2G	SC-88A	L8	Q4	3000 / Tape & Reel
NLV17SZ86DFT2G	SC-88A	L8	Q4	3000 / Tape & Reel
NL17SZ86DBVT1G	SC-74A	AQ	Q4	3000 / Tape & Reel
NL17SZ86XV5T2G (In Development)	SOT-553	TBD	Q4	4000 / Tape & Reel
NL17SZ86P5T5G	SOT-953	P (Rotated 180° CW)	Q2	8000 / Tape & Reel
NL17SZ86P5T5G-L22088	SOT-953	P (Rotated 180° CW)	Q2	8000 / Tape & Reel
NL17SZ86MU1TCG (In Development)	UDFN6, 1.45 x 1.0, 0.5P	TBD	Q4	3000 / Tape & Reel
NL17SZ86MU3TCG (In Development)	UDFN6, 1.0 x 1.0, 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.

\*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

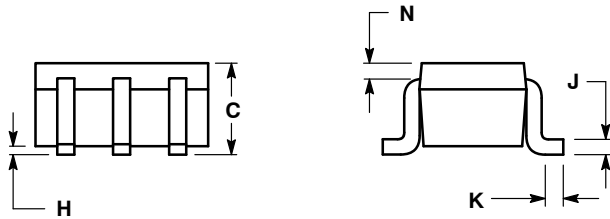
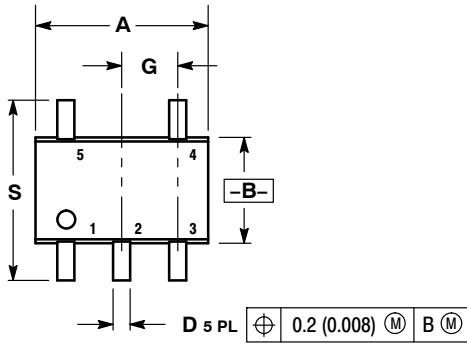
Direction of Feed



# NL17SZ86

## PACKAGE DIMENSIONS

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

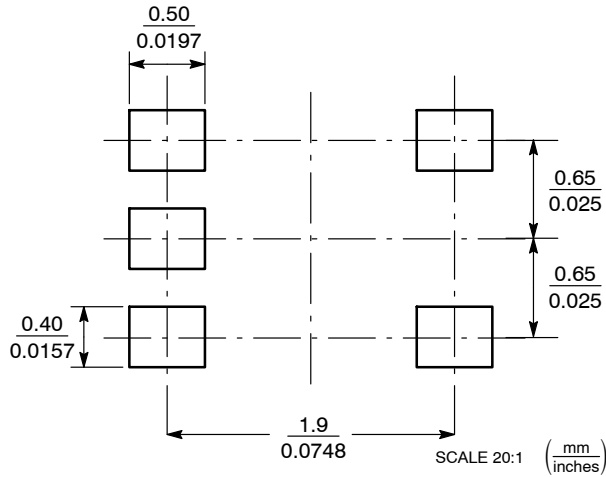


**NOTES:**

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		0.65 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\*



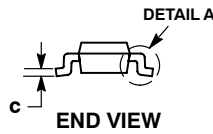
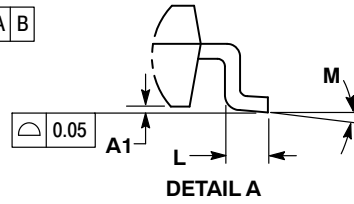
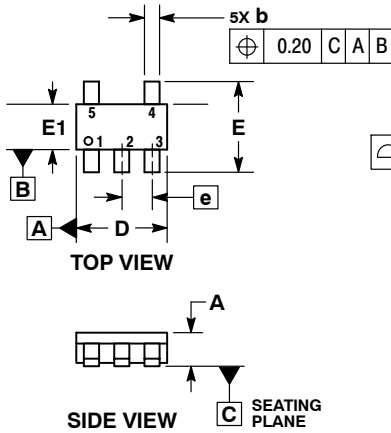
\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



# NL17SZ86

## PACKAGE DIMENSIONS

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

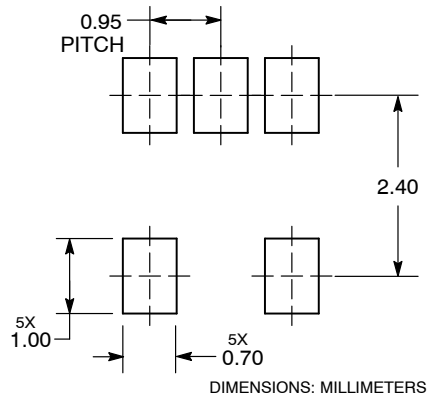


#### NOTES:

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\*

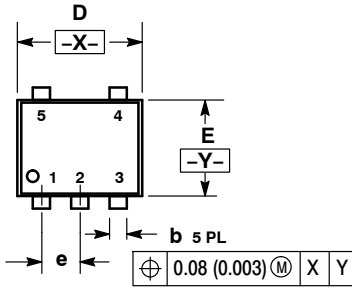


\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# NL17SZ86

## PACKAGE DIMENSIONS

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

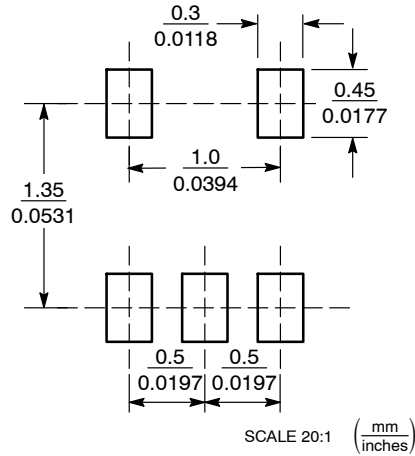


NOTES:

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 <sub>E</sub>	1.55	1.60	1.65	0.061	0.063	0.065

### SOLDERING FOOTPRINT\*

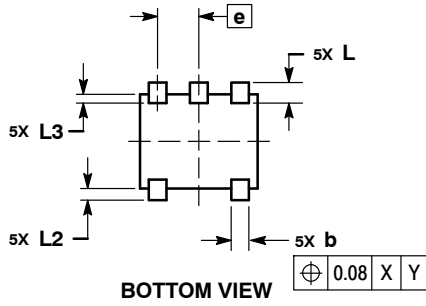
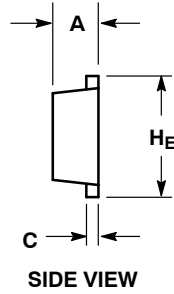
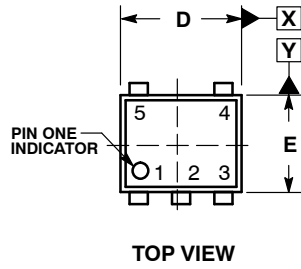


\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# NL17SZ86

## PACKAGE DIMENSIONS

SOT-953  
CASE 527AE  
ISSUE E

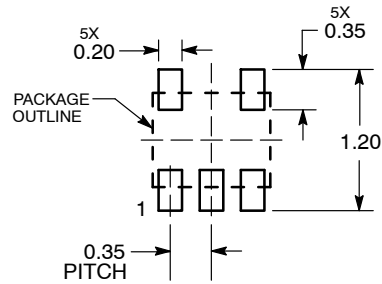


NOTES:

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.

MILLIMETERS			
DIM	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 <sub>E</sub>	0.95	1.00	1.05
L	0.175 REF		
L2	0.05	0.10	0.15
L3	---	---	0.15

### SOLDERING FOOTPRINT\*



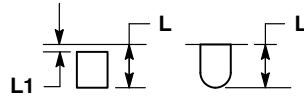
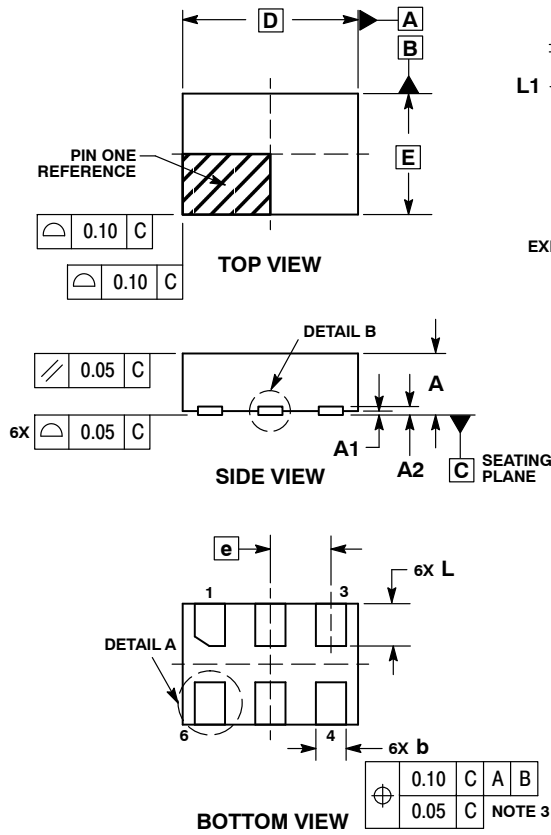
DIMENSIONS: MILLIMETERS

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

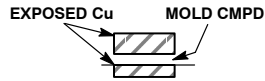
# NL17SZ86

## PACKAGE DIMENSIONS

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



**DETAIL A**  
OPTIONAL  
CONSTRUCTIONS



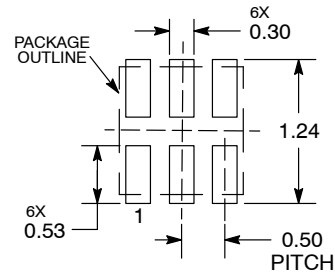
**DETAIL B**  
OPTIONAL  
CONSTRUCTIONS

**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
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



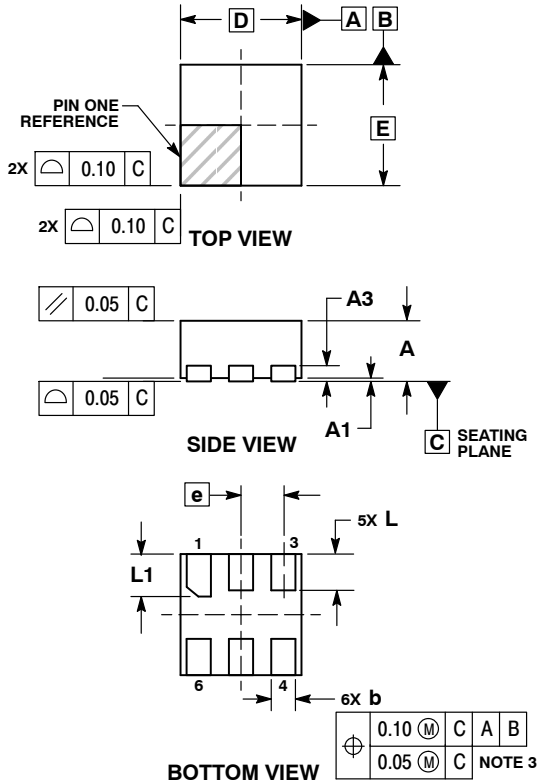
DIMENSIONS: MILLIMETERS

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

# NL17SZ86

## PACKAGE DIMENSIONS

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

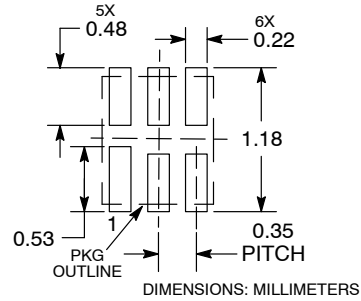


**NOTES:**

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.

DIM	MILLIMETERS	
	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	1.00 BSC	
e	0.35 BSC	
L	0.25	0.35
L1	0.30	0.40

**RECOMMENDED SOLDERING FOOTPRINT\***



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