2-Input NAND Gate, Open Drain Output

NL17SZ38

The NL17SZ38 is a single 2−Input NAND gate with open drain output operating from a 1.65 V to 5.5 V supply.

Features

- Designed for 1.65 V to 5.5 V V_{CC} Operation
- 2.2 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
- Sink 32 mA at 4.5 V
- Available in SC−88, SC−74 and UDFN6 Packages
- Chip Complexity < 100 FETs
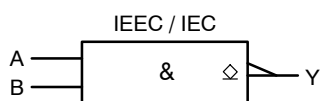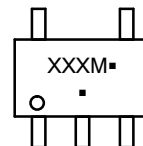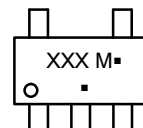- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

IEEC / IEC

Figure 1. Logic Symbol

MARKING DIAGRAMS

SC−88A DF SUFFIX CASE 419A		XXXM▪ ○ ▪
SC−74A DBV SUFFIX CASE 318BQ		XXX M▪ ○ ▪
UDFN6 1.45 x 1.0 CASE 517AQ	1	XM ●
UDFN6 1.0 x 1.0 CASE 517BX		X M ○ 1
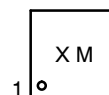
X, XXX = Specific Device Code
M = Date Code*
▪ = Pb−Free Package

(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 6 of this data sheet.
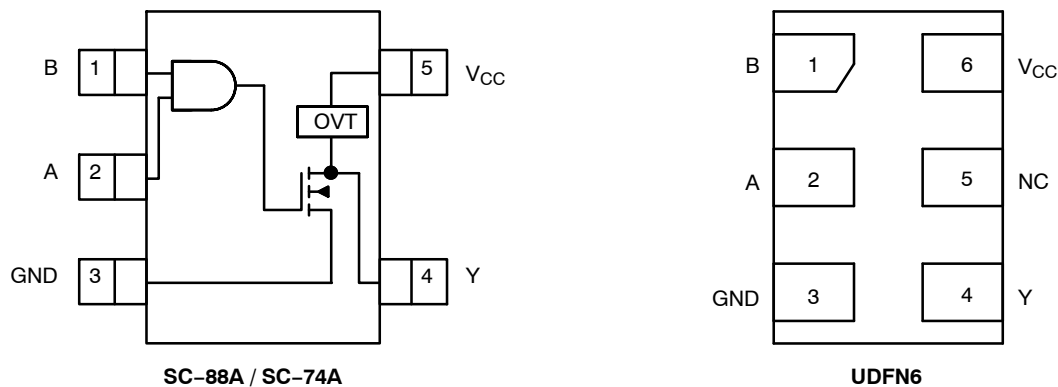
NL17SZ38

SC−88A / SC−74A

UDFN6

Figure 2. Pinout (Top View)

PIN ASSIGNMENT (SC−88A/SC−74A)

Pin	Function
1	B
2	A
3	GND
4	Y
5	V_{CC}

PIN ASSIGNMENT (UDFN)

Pin	Function
1	B
2	A
3	GND
4	Y
5	NC
6	V_{CC}

FUNCTION TABLE

Inputs		Output
A	**B**	**Y**
L	L	Z
L	H	Z
H	L	Z
H	H	L

MAXIMUM RATINGS

Symbol	Characteristics		Value	Unit
V_{CC}	DC Supply Voltage		−0.5 to +6.5	V
V_{IN}	DC Input Voltage		−0.5 to +6.5	V
V_{OUT}	DC Output Voltage	Active−Mode (High or Low State) Tri−State Mode (Note 1) Power−Down Mode (V_{CC} = 0 V)	−0.5 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 UDFN6	377 320 154	°C/W
P_D	Power Dissipation in Still Air	SC−88A SC−74A UDFN6	332 390 812	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.
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	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	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	ns

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.

NL17SZ38

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V_{CC} (V)	$T_A = 25°C$			$-55°C \leq T_A \leq 125°C$		Units
				Min	Typ	Max	Min	Max	
V_{IH}	High–Level Input Voltage		1.65 to 1.95	0.65 V_{CC}	–	–	0.65 V_{CC}	–	V
			2.3 to 5.5	0.70 V_{CC}	–	–	0.70 V_{CC}	–	
V_{IL}	Low–Level Input Voltage		1.65 to 1.95	–	–	0.35 V_{CC}	–	0.35 V_{CC}	V
			2.3 to 5.5	–	–	0.30 V_{CC}	–	0.30 V_{CC}	
V_{OL}	Low–Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $I_{OH} = 100$ μA $I_{OH} = 4$ mA $I_{OH} = 8$ mA $I_{OH} = 16$ mA $I_{OH} = 24$ mA $I_{OH} = 32$ mA	1.65 to 5.5 1.65 2.3 3 3 4.5	– – – – – –	– 0.08 0.12 0.24 0.26 0.31	0.1 0.24 0.3 0.4 0.55 0.55	– – – – – –	0.1 0.24 0.3 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
I_{OZ}	3–State Output Leakage Current	$V_{OUT} = 0$ V to 5.5 V	1.65 to 5.5	–	–	±0.5	–	±5.0	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.
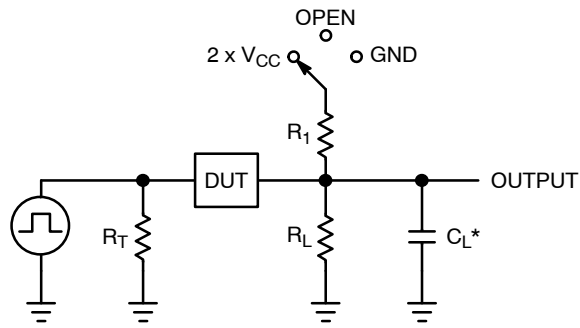
AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = +25°C$			$T_A = -55$ to $+125°C$		Unit
				Min	Typ	Max	Min	Max	
t_{PZL}	Propagation Delay, (A or B) to Y (Figure 3, 4)		1.65 to 1.95	–	6.5	12.7	–	13.2	ns
			2.3 to 2.7	–	3.5	7.0	–	7.5	
			3.0 to 3.6	–	2.8	5.0	–	5.2	
			4.5 to 5.5	–	2.2	4.3	–	4.5	
t_{PLZ}	Propagation Delay, (A or B) to Y (Figure 3, 4)		1.65 to 1.95	–	5.5	12.7	–	13.2	ns
			2.3 to 2.7	–	3.0	7.0	–	7.5	
			3.0 to 3.6	–	2.1	5.0	–	5.2	
			4.5 to 5.5	–	1.3	4.3	–	4.5	

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}	4.0	pF
C_{PD}	Power Dissipation Capacitance (Note 5)	10 MHz, $V_{CC} = 5.5$ V, $V_{IN} = 0$ V or V_{CC}	4.0	pF

5. C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. C_{PD} is related to I_{CCD} dynamic operating current by the expression:
$I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CC}static)$.

NL17SZ38

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 x 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 Ω)
f = 1 MHz

Figure 3. Test Circuit
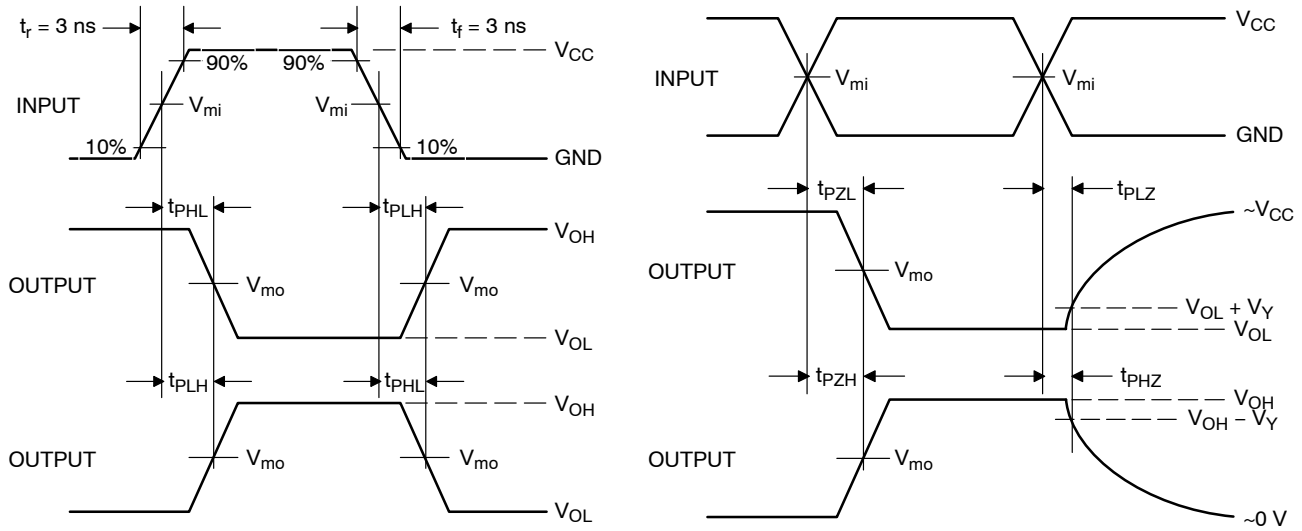
Figure 4. Switching Waveforms

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

DEVICE ORDERING INFORMATION

Device	Packages	Specific Device Code	Pin 1 Orientation (See below)	Shipping[†]
NL17SZ38DFT2G (In Development)	SC−88A	TBD	Q4	3000 / Tape & Reel
NL17SZ38DBVT1G	SC−74A	AT	Q4	3000 / Tape & Reel
NL17SZ38MU1TCG (In Development)	UDFN6, 1.45 x 1.0, 0.5P	TBD	Q4	3000 / Tape & Reel
NL17SZ38MU3TCG (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.

Pin 1 Orientation in Tape and Reel
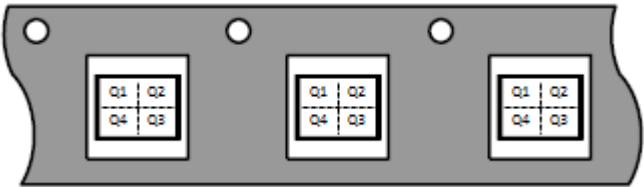
PACKAGE DIMENSIONS

SC−88A (SC−70−5/SOT−353)
CASE 419A−02
ISSUE M

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. 419A−01 OBSOLETE. NEW STANDARD 419A−02
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.1016MM PER SIDE.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.80	0.95	1.10
A1	---	---	0.10
A3	0.20 REF		
b	0.10	0.20	0.30
c	0.10	---	0.25
D	1.80	2.00	2.20
E	2.00	2.10	2.20
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.10	0.15	0.30

5X b

⊕ 0.2 Ⓜ B Ⓜ
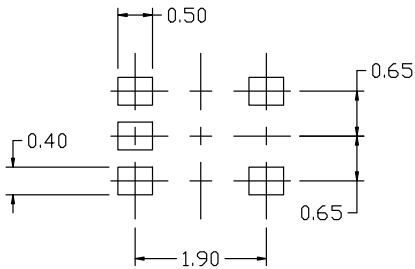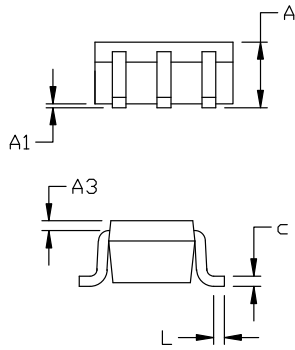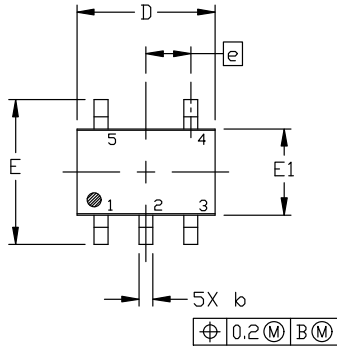
RECOMMENDED
MOUNTING FOOTPRINT

✳ For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.
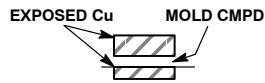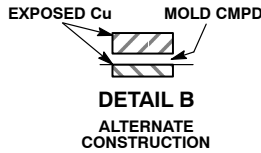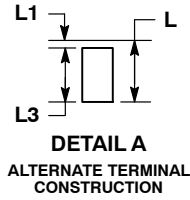
NL17SZ38

PACKAGE DIMENSIONS

SC−74A
CASE 318BQ
ISSUE B
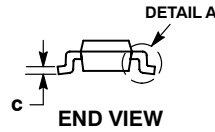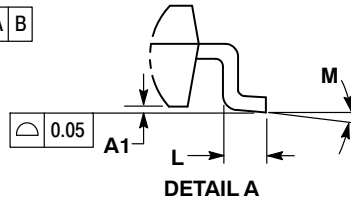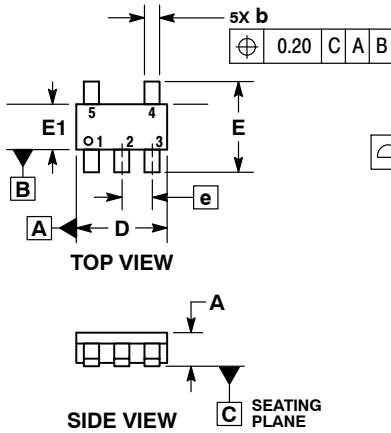
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.

TOP VIEW

SIDE VIEW

DETAIL A

END VIEW

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*
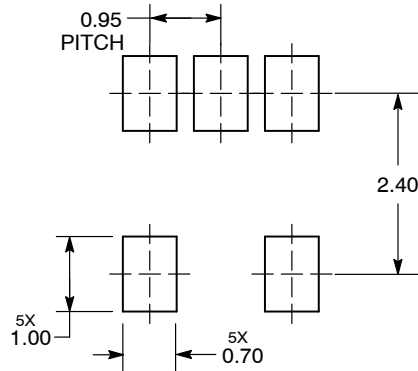
0.95 PITCH

2.40

5X 1.00

5X 0.70

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.

NL17SZ38

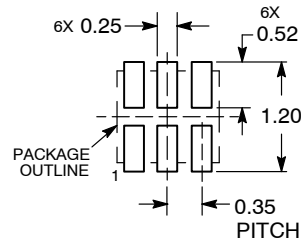## PACKAGE DIMENSIONS

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

TOP VIEW

PIN ONE REFERENCE

0.10 C

0.10 C

SIDE VIEW

0.05 C

6X 0.05 C

DETAIL B

A
A1
A2
C SEATING PLANE

BOTTOM VIEW

DETAIL A

e
6X L
6X b

0.10	C	A	B
0.05	C	NOTE 3	
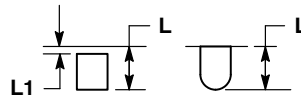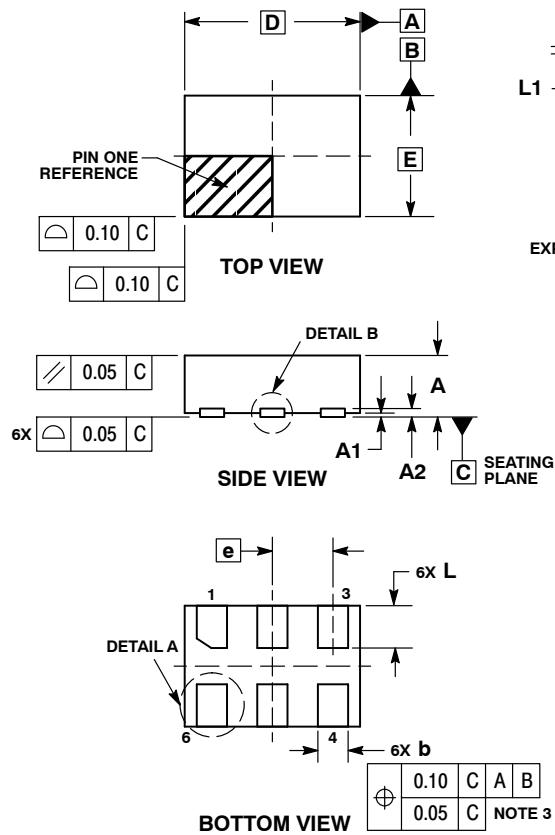
DETAIL A
OPTIONAL CONSTRUCTIONS

L
L1
L

DETAIL B
OPTIONAL CONSTRUCTIONS

EXPOSED Cu   MOLD CMPD

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	
	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
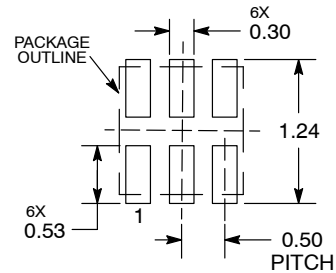
PACKAGE OUTLINE

6X 0.30
1.24
6X 0.53
0.50 PITCH

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.

NL17SZ38

PACKAGE DIMENSIONS

UDFN6, 1x1, 0.35P
CASE 517BX
ISSUE O
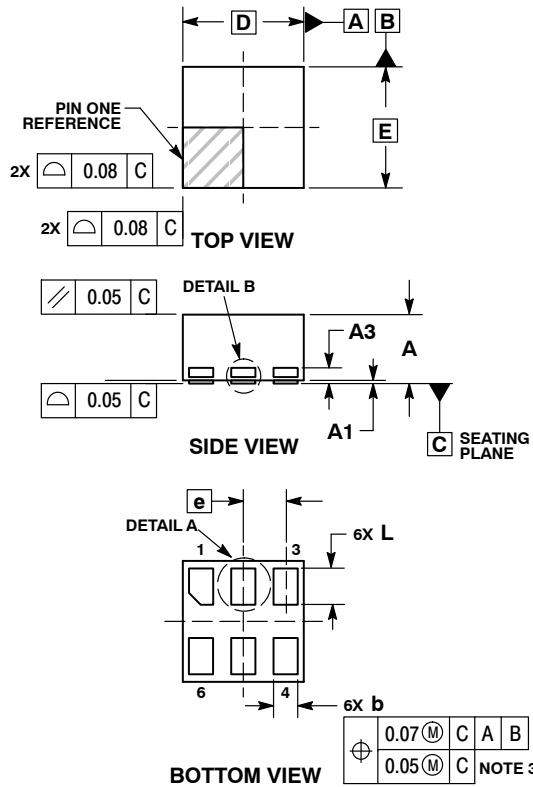
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP.
4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

DIM	MILLIMETERS	
	MIN	MAX
A	0.50	0.65
A1	0.00	0.05
A3	0.13 REF	
b	0.17	0.23
D	1.00 BSC	
E	1.00 BSC	
e	0.35	
L	0.20	0.40
L1	---	0.15
L3	0.26	0.33

TOP VIEW

DETAIL A
ALTERNATE TERMINAL CONSTRUCTION

DETAIL B
ALTERNATE CONSTRUCTION

SIDE VIEW

BOTTOM VIEW

RECOMMENDED SOLDERING FOOTPRINT*

DIMENSION: MILLIMETERS

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

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales

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