onsemi

Buffer with Open Drain Output

NL17SG07

The NL17SG07 MiniGate™ is an advanced high−speed CMOS Buffer with Open Drain Output in ultra−small footprint.

The NL17SG07 input structures provides protection when voltages up to 3.6 V.

Features

- Wide Operating V_{CC} Range: 0.9 V to 3.6 V
- High Speed: t_{PD} = 2.5 ns (Typ) at V_{CC} = 3.0 V, C_L = 15 pF
- Low Power Dissipation: I_{CC} = 0.5 μA (Max) at T_A = 25°C
- 3.6 V Overvoltage Tolerant (OVT) Input Pins
- I_{OFF} Supports Partial Power Down Protection
- Ultra−Small Packages
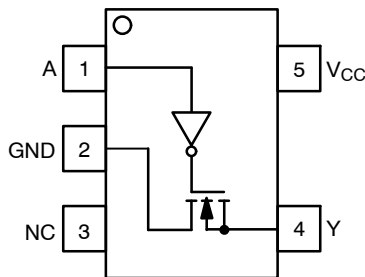- These are Pb−Free and Halide−Free Devices
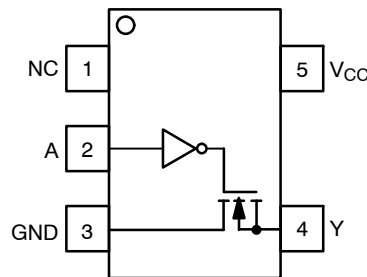

Figure 1. SOT−953
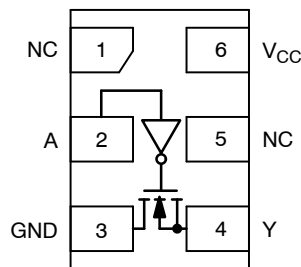(Top View)

Figure 2. SC−88A
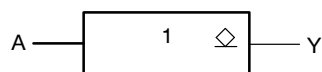(Top View)

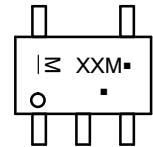**Figure 3. UDFN**
(Top View)

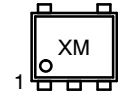**Figure 4. Logic Symbol**

MARKING DIAGRAMS

SC−88A
DF SUFFIX
CASE 419A

SOT−953
CASE 527AE

UDFN6
1.0 x 1.0
CASE 517BX

UDFN6
1.45 x 1.0
CASE 517AQ
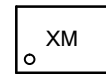
XX = Specific Device Code
M = Date Code*
▪ = Pb−Free Package

(Note: Microdot may be in either location)

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

PIN ASSIGNMENT

PIN	SOT−953	SC−88A	UDFN6
1	A	NC	NC
2	GND	A	A
3	NC	GND	GND
4	Y	Y	Y
5	V_{CC}	V_{CC}	NC
6	–	–	V_{CC}

FUNCTION TABLE

Input A	Output Y
L	L
H	Z

ORDERING INFORMATION

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

NL17SG07

Table 1. MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{CC}	DC Supply Voltage		−0.5 to +4.3	V
V_{IN}	DC Input Voltage		−0.5 to +4.3	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 +4.3 −0.5 to +4.3	V
I_{IK}	DC Input Diode Current	V_{IN} < GND	−20	mA
I_{OK}	DC Output Diode Current	V_{OUT} < GND	−20	mA
I_{OUT}	DC Output Source/Sink Current		±20	mA
$I_{CC\ or}\ I_{GND}$	DC Supply Current Per Supply Pin or Ground Pin		±20	mA
T_{STG}	Storage Temperature Range		−65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
T_J	Junction Temperature Under Bias		+150	°C
θ_{JA}	Thermal Resistance (Note 2)	SC−88A SOT−953 UDFN6	377 254 154	°C/W
P_D	Power Dissipation in Still Air at 85°C	SC−88A SOT−953 UDFN6	332 491 812	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.
1. Applicable to devices with outputs that may be tri−stated.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm − by − 1inch, 2 ounce copper trace no air flow per JESD51−7.
3. HBM tested to EIA / JESD22−A114−A. CDM tested to JESD22−C101−A. JEDEC recommends that ESD qualification to EIA/JESD22−A115A (Machine Model) be discontinued.
4. Tested to EIA/JESD78 Class II.

Table 2. RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	Positive DC Supply Voltage		0.9	3.6	V
V_{IN}	Digital Input Voltage		0	3.6	V
V_{OUT}	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} 3.6 3.6	V
T_A	Operating Free−Air Temperature		−55	+125	°C
t_r, t_f	Input Transition Rise or Fall Rate	V_{CC} = 3.3 V ± 0.3 V	0	10	nS/V

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.

NL17SG07

Table 3. DC ELECTRICAL CHARACTERISTICS

| Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = 25°C$			$T_A = -55°C$ to $+125°C$		Unit
				Min	Typ	Max	Min	Max	
V_{IH}	High–Level Input Voltage		0.9	–	V_{CC}	–	–	–	V
			1.1 to 1.3	$0.7 \times V_{CC}$	–	–	$0.7 \times V_{CC}$	–	
			1.4 to 1.6	$0.65 \times V_{CC}$	–	–	$0.65 \times V_{CC}$	–	
			1.65 to 1.95	$0.65 \times V_{CC}$	–	–	$0.65 \times V_{CC}$	–	
			2.3 to 2.7	1.7	–	–	1.7	–	
			3.0 to 3.6	2.0	–	–	2.0	–	
V_{IL}	Low–Level Input Voltage		0.9	–	GND	–	–	–	V
			1.1 to 1.3	–	–	$0.3 \times V_{CC}$	–	$0.3 \times V_{CC}$	
			1.4 to 1.6	–	–	$0.35 \times V_{CC}$	–	$0.35 \times V_{CC}$	
			1.65 to 1.95	–	–	$0.35 \times V_{CC}$	–	$0.35 \times V_{CC}$	
			2.3 to 2.7	–	–	0.7	–	0.7	
			3.0 to 3.6	–	–	0.8	–	0.8	
V_{OL}	Low–Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL}							V
		$I_{OL} = 20\ \mu A$	0.9	–	0.1	–	–	–	
		$I_{OL} = 0.3$ mA	1.1 to 1.3	–	–	$0.25 \times V_{CC}$	–	$0.25 \times V_{CC}$	
		$I_{OL} = 1.7$ mA	1.4 to 1.6	–	–	$0.25 \times V_{CC}$	–	$0.25 \times V_{CC}$	
		$I_{OL} = 3.0$ mA	1.65 to 1.95	–	–	0.45	–	0.45	
		$I_{OL} = 4.0$ mA	2.3 to 2.7	–	–	0.4	–	0.4	
		$I_{OL} = 8.0$ mA	2.7 to 3.6	–	–	0.4	–	0.4	
I_{IN}	Input Leakage Current	$V_{IN} = 0$ V to 3.6 V	0.9 to 3.6	–	–	±0.1	–	±1.0	μA
I_{OFF}	Power Off Leakage Current	$V_{IN} = 0$ V to 3.6 V; $V_{OUT} = 0$ V to 3.6 V	0	–	–	1.0	–	10.0	μA
I_{CC}	Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	0.9 to 3.6	–	–	1.0	–	10.0	μA
I_{OZ}	3–State Output Leakage Current	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0$ to 3.6V	0.9 to 3.6	–	–	1.0	–	10.0	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.

Table 4. AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Condition	V$_{CC}$ (V)	T$_A$ = 25°C			T$_A$ = −55°C to +125°C		Unit
				Min	Typ	Max	Min	Max	
t$_{PZL}$	Propagation Delay, Enable Time, A to Y	C$_L$ = 10 pF, R$_1$ = R$_L$ = 5 kΩ	0.9	–	54.8	–	–	–	ns
			1.1 to 1.3	–	10.7	26.8	–	32.2	
			1.4 to 1.6	–	4.0	6.8	–	7.3	
			1.65 to 1.95	–	3.3	3.9	–	5.9	
			2.3 to 2.7	–	2.7	3.3	–	4.5	
			3.0 to 3.6	–	2.4	2.9	–	3.7	
		C$_L$ = 15 pF, R$_1$ = R$_L$ = 5 kΩ	0.9	–	57.4	–	–	–	ns
			1.1 to 1.3	–	10.9	27.5	–	33.0	
			1.4 to 1.6	–	4.1	7.0	–	7.4	
			1.65 to 1.95	–	3.4	4.0	–	6.2	
			2.3 to 2.7	–	2.8	3.4	–	4.6	
			3.0 to 3.6	–	2.5	3.0	–	3.7	
		C$_L$ = 30 pF, R$_1$ = R$_L$ = 5 kΩ	0.9	–	65.3	–	–	–	ns
			1.1 to 1.3	–	11.5	29.4	–	35.1	
			1.4 to 1.6	–	4.5	7.5	–	7.6	
			1.65 to 1.95	–	3.5	4.2	–	6.4	
			2.3 to 2.7	–	3.0	3.6	–	4.7	
			3.0 to 3.6	–	2.6	3.1	–	3.9	
t$_{PLZ}$	Propagation Delay, Disable Time, A to Y	C$_L$ = 10 pF, R$_1$ = R$_L$ = 5 kΩ	0.9	–	23.7	–	–	–	ns
			1.1 to 1.3	–	8.3	16.4	–	18.1	
			1.4 to 1.6	–	5.2	8.1	–	8.3	
			1.65 to 1.95	–	4.9	8.0	–	8.1	
			2.3 to 2.7	–	3.8	6.5	–	7.3	
			3.0 to 3.6	–	3.5	7.5	–	7.7	
		C$_L$ = 15 pF, R$_1$ = R$_L$ = 5 kΩ	0.9	–	28.1	–	–	–	ns
			1.1 to 1.3	–	9.3	18.6	–	20.6	
			1.4 to 1.6	–	7.9	10	–	10.8	
			1.65 to 1.95	–	7.6	9.5	–	10.5	
			2.3 to 2.7	–	6.3	9.0	–	10	
			3.0 to 3.6	–	6.0	8.7	–	9.3	
		C$_L$ = 30 pF, R$_1$ = R$_L$ = 5 kΩ	0.9	–	41.1	–	–	–	ns
			1.1 to 1.3	–	12.4	24.2	–	27.1	
			1.4 to 1.6	–	13	15	–	16	
			1.65 to 1.95	–	12.5	14.5	–	15.8	
			2.3 to 2.7	–	11.2	13.5	–	15.4	
			3.0 to 3.6	–	11	13.2	–	14.3	
C$_{IN}$	Input Capacitance		0 to 3.6	–	3	–	–	–	pF
C$_{PD}$	Power Dissipation Capacitance (Note 5)		0.9 to 3.6	–	4	–	–	–	pF

5. C$_{PD}$ is defined as the value of the internal equivalent capacitance which is calculated from the dynamic operating current consumption without load. Average operating current can be obtained by the equation: $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$. C$_{PD}$ is used to determine the no−load dynamic power consumption; $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.
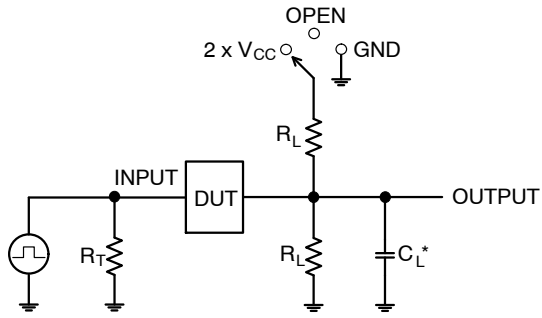
C$_L$ includes probe and jig capacitance
R$_T$ is Z$_{OUT}$ of pulse generator (typically 50 W)
f = 1 MHz

Figure 5. Test Circuit

Test	Switch Position
t$_{PLH}$ / t$_{PHL}$	Open
t$_{PLZ}$ / t$_{PZL}$	2 x V$_{CC}$
t$_{PHZ}$ / t$_{PZH}$	GND
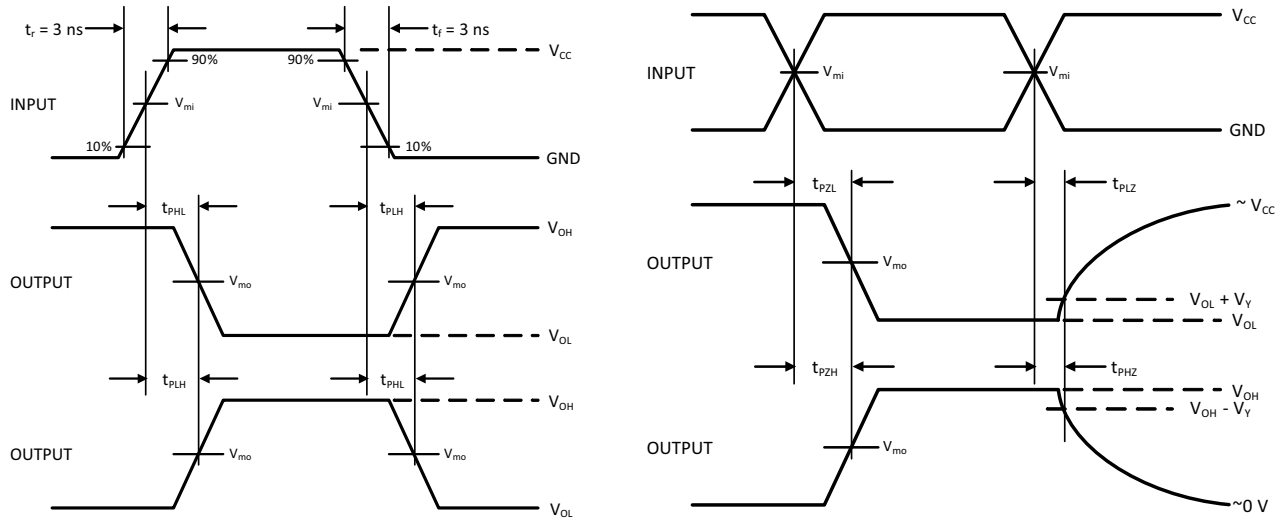
Figure 6. Switching Waveforms

V$_{CC}$, V	V$_{mi}$, V	V$_{mo}$, V	V$_Y$, V
0.9	V$_{CC}$/2	V$_{CC}$/2	0.1
1.1 to 1.3	V$_{CC}$/2	V$_{CC}$/2	0.1
1.4 to 1.6	V$_{CC}$/2	V$_{CC}$/2	0.1
1.65 to 1.95	V$_{CC}$/2	V$_{CC}$/2	0.15
2.3 to 2.7	V$_{CC}$/2	V$_{CC}$/2	0.15
3.0 to 3.6	1.5	1.5	0.3

NL17SG07

Device	Marking	Pin 1 Orientation (See below)	Package	Shipping[†]
NL17SG07DFT2G	AQ	Q4	SC−88A	3000 / Tape & Reel
NL17SG07P5T5G	6	Q2	SOT−953	8000 / Tape & Reel
NL17SG07MU1TCG	V (Rotated 180°CW)	Q4	UDFN6 1.45x1 mm	3000 / Tape & Reel
NL17SG07MU3TBG	V (Rotated 180°CW)	Q2	UDFN6 1x1 mm	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.

*−Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable.

PIN 1 ORIENTATION IN TAPE AND REEL
Direction of Feed
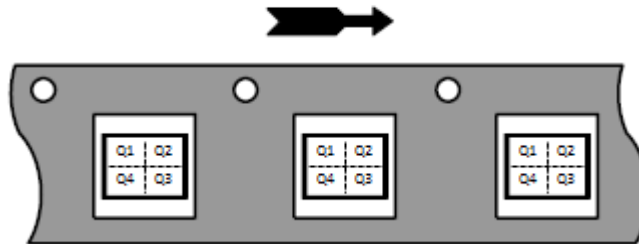
NL17SG07

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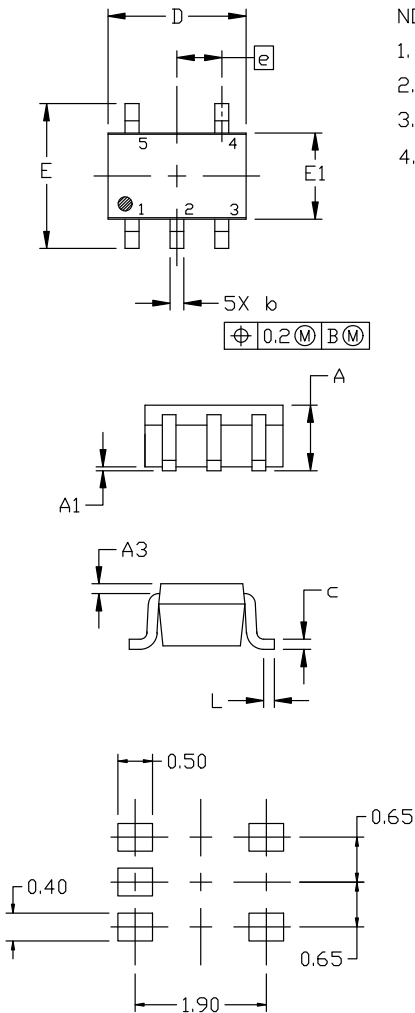
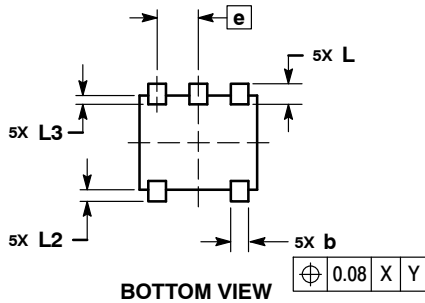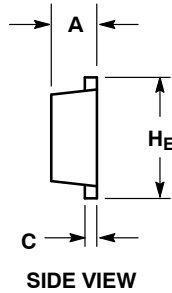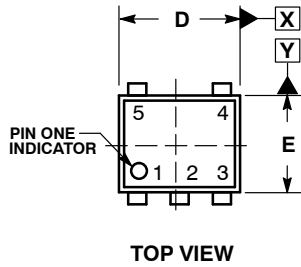| DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.80	0.95	1.10
A1	---	---	0.10
A3	0.20 REF		
b	0.10	0.20	0.30
c	0.10	---	0.25
D	1.80	2.00	2.20
E	2.00	2.10	2.20
E1	1.15	1.25	1.35
e	0.65 BSC		
L	0.10	0.15	0.30

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.

NL17SG07

PACKAGE DIMENSIONS

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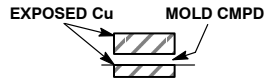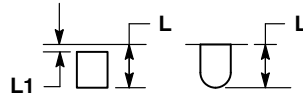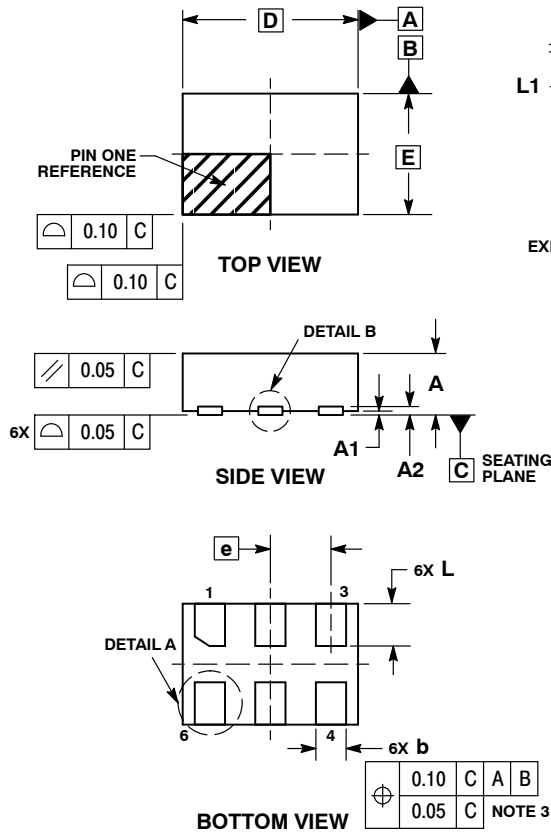
TOP VIEW

PIN ONE REFERENCE

SIDE VIEW

DETAIL B

6X

A1 A2 C SEATING PLANE

BOTTOM VIEW

DETAIL A

6X L

6X b

| ⊕ | 0.10 | C | A | B |
| | 0.05 | C | NOTE 3 |

DETAIL A
OPTIONAL CONSTRUCTIONS

L1 L 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
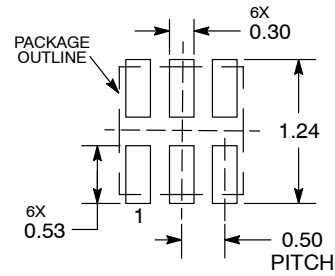
PACKAGE OUTLINE

6X 0.30

1.24

6X 0.53

1

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.

NL17SG07

PACKAGE DIMENSIONS

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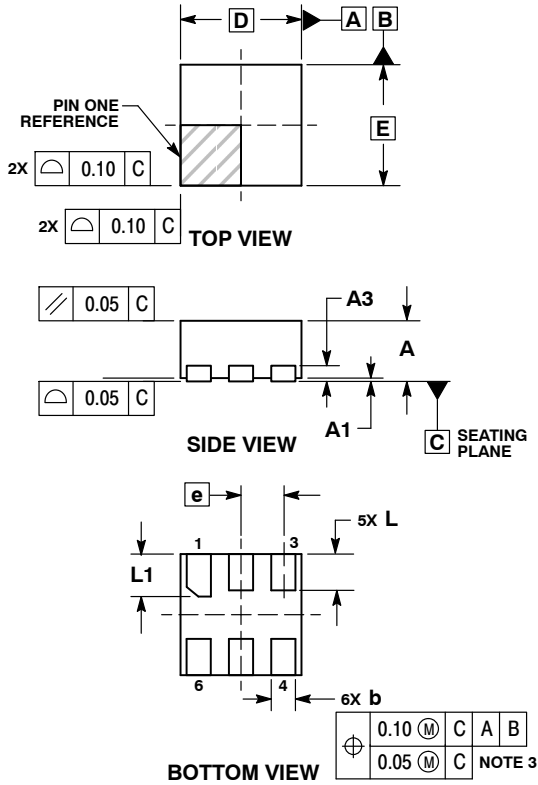
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP.
4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

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

TOP VIEW

SIDE VIEW

BOTTOM VIEW

RECOMMENDED SOLDERING FOOTPRINT*
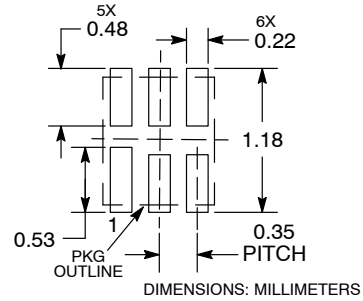
DIMENSIONS: MILLIMETERS

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

NL17SG07

PACKAGE DIMENSIONS

SOT−953
CASE 527AE
ISSUE E

TOP VIEW

SIDE VIEW

BOTTOM 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.

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		
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.

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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