

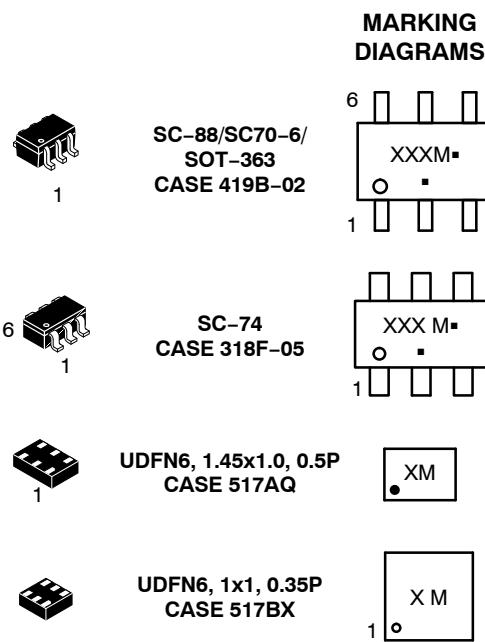
# Configurable Multifunction Gate

## NL7SZ98

The NL7SZ98 is an advanced high-speed CMOS multifunction gate. The device allows the user to choose logic functions MUX, AND, OR, NAND, NOR, INVERT and BUFFER. The device has Schmitt-trigger inputs, thereby enhancing noise immunity.

### Features

- Designed for 1.65 V to 5.5 V V<sub>CC</sub> Operation
- 3.3 ns t<sub>PD</sub> at V<sub>CC</sub> = 5 V (Typ)
- Inputs/Outputs 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-88, SC-74 and UDFN6 Packages
- Chip Complexity < 100 FETs
- –Q Suffix 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



XXX = Specific Device Code

M = Date Code\*

▪ = Pb-Free Package

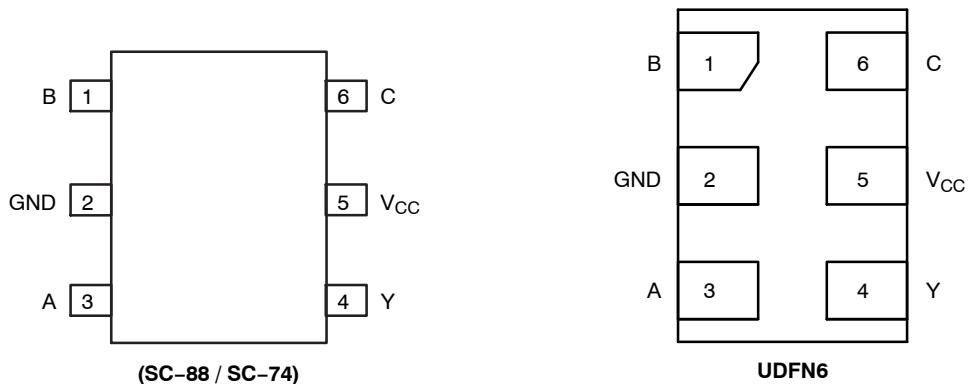
(Note: Microdot may be in either location or may not be present)

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

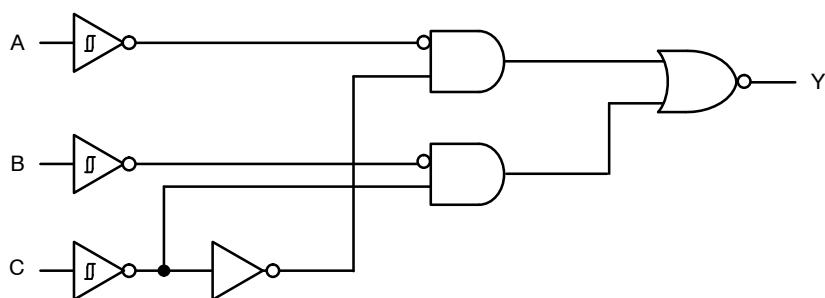
### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

**NL7SZ98**



**Figure 1. Pinout (Top View)**



**Figure 2. Function Diagram**

## PIN ASSIGNMENT

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

## FUNCTION TABLE\*

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

\*To select a logic function, please refer to “Logic Configurations section”.

LOGIC CONFIGURATIONS

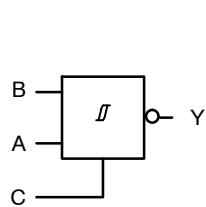


Figure 3. 2-Input MUX with Output Inverted

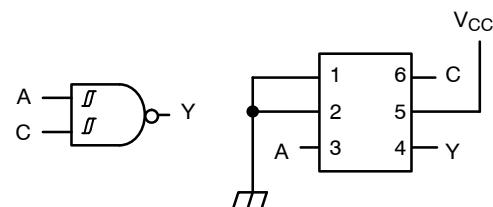
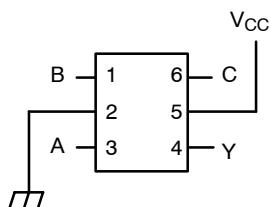


Figure 4. 2-Input NAND (When B = "L")

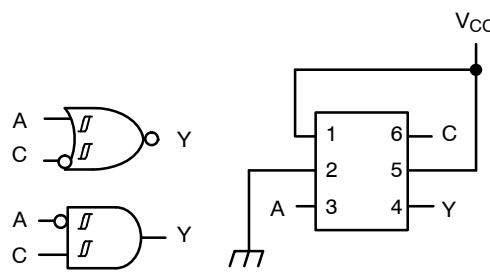


Figure 5. 2-Input NOR with Input C Inverted (When B = "H")

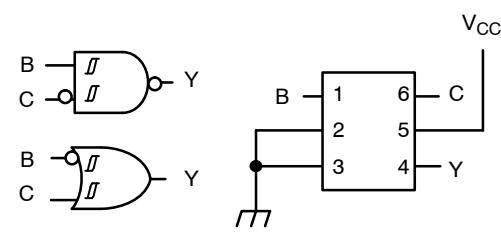


Figure 6. 2-Input NAND with Input C Inverted (When A = "L")

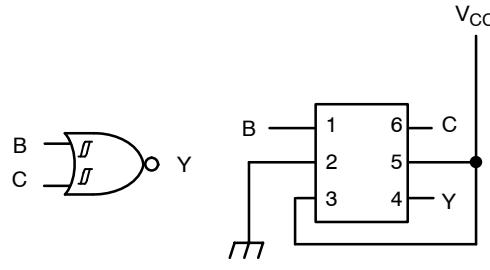


Figure 7. 2-Input NOR (When A = "H")

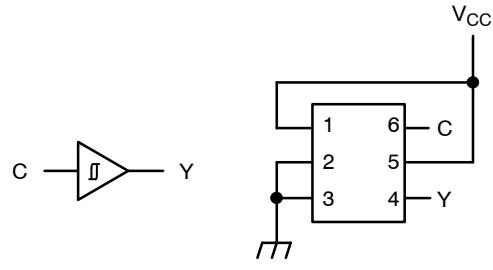


Figure 8. Buffer (When A = "L" and B = "H")

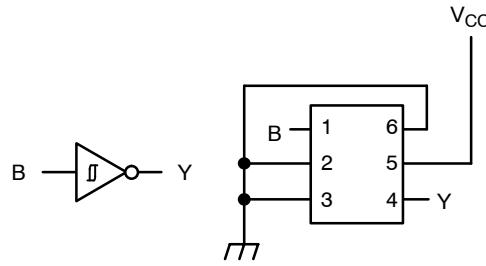


Figure 9. Inverter (When A = C = "L")

## MAXIMUM RATINGS

Symbol	Parameter	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
$I_{IK}$	DC Input Diode Current	$V_{IN} < GND$	-50
$I_{OK}$	DC Output Diode Current	$V_{OUT} < GND$	-50
$I_{OUT}$	DC Output Source/Sink Current	$\pm 50$	mA
$I_{CC}$ or $I_{GND}$	DC Supply Current per Supply Pin or Ground Pin	$\pm 100$	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
$\theta_{JA}$	Thermal Resistance (Note 2)	SC-88 SC-74 UDFN6	377 320 154
$P_D$	Power Dissipation in Still Air	SC-88 SC-74 UDFN6	332 390 812
MSL	Moisture Sensitivity	Level 1	
$F_R$	Flammability Rating Oxygen	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in
$V_{ESD}$	ESD Withstand Voltage (Note 3)	Human Body Mode Charged Device Model	>2000 >200
$I_{LATCHUP}$	Latchup Performance (Note 4)	$\pm 100$	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–1 inch, 2 ounce copper trace no air flow per JESD51–7.
3. 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	Parameter	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	0	5.5	V	
$T_A$	Operating Free–Air Temperature	-55	+125	°C	
$t_r, t_f$	Input Rise or Fall Rate	$V_{CC} = 1.65$ 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	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.

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			-40°C ≤ T <sub>A</sub> ≤ 85°C		-55°C ≤ T <sub>A</sub> ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
V <sub>T+</sub>	Positive Input Threshold Voltage		1.65	—	—	1.4	—	1.4	—	1.4	V
			2.3	—	—	1.8	—	1.8	—	1.8	
			3.0	—	—	2.2	—	2.2	—	2.2	
			4.5	—	—	3.1	—	3.1	—	3.1	
			5.5	—	—	3.6	—	3.6	—	3.6	
V <sub>T-</sub>	Negative Input Threshold Voltage		1.65	0.2	—	—	0.2	—	0.2	—	V
			2.3	0.4	—	—	0.4	—	0.4	—	
			3.0	0.6	—	—	0.6	—	0.6	—	
			4.5	1.0	—	—	1.0	—	1.0	—	
			5.5	1.2	—	—	1.2	—	1.2	—	
V <sub>H</sub>	Negative Input Threshold Voltage		1.65	0.1	0.48	0.9	0.1	0.9	0.1	0.9	V
			2.3	0.25	0.75	1.1	0.25	1.1	0.25	1.1	
			3.0	0.4	0.93	1.2	0.4	1.2	0.4	1.2	
			4.5	0.6	1.2	1.5	0.6	1.5	0.6	1.5	
			5.5	0.7	1.4	1.7	0.7	1.7	0.7	1.7	
V <sub>OH</sub>	High-Level Output Voltage	I <sub>OH</sub> = -50 µA	1.65 to 5.5	V <sub>CC</sub> - 0.1	V <sub>CC</sub>	—	V <sub>CC</sub> - 0.1	—	V <sub>CC</sub> - 0.1	—	V
		I <sub>OH</sub> = -4 mA	1.65	1.20	1.52	—	1.20	—	1.20	—	
		I <sub>OH</sub> = -8 mA	2.3	1.9	2.1	—	1.9	—	1.9	—	
		I <sub>OH</sub> = -16 mA	3	2.4	2.7	—	2.4	—	2.4	—	
		I <sub>OH</sub> = -24 mA	3	2.3	2.5	—	2.3	—	2.3	—	
		I <sub>OH</sub> = -32 mA	4.5	3.8	4	—	3.8	—	3.8	—	
V <sub>OL</sub>	Low-Level Output Voltage	I <sub>OL</sub> = 100 µA	1.65 to 5.5	—	—	0.1	—	0.1	—	0.1	V
		I <sub>OL</sub> = 4 mA	1.65	—	0.08	0.45	—	0.45	—	0.45	
		I <sub>OL</sub> = 8 mA	2.3	—	0.2	0.3	—	0.3	—	0.4	
		I <sub>OL</sub> = 16 mA	3	—	0.28	0.4	—	0.4	—	0.5	
		I <sub>OL</sub> = 24 mA	3	—	0.38	0.55	—	0.55	—	0.55	
		I <sub>OL</sub> = 32 mA	4.5	—	0.42	0.55	—	0.55	—	0.65	
I <sub>IN</sub>	Input Leakage Current	V <sub>IN</sub> = 5.5 V or GND	1.65 to 5.5	—	—	+0.1	—	+1.0	—	+1.0	µA
I <sub>OFF</sub>	Power Off Leakage Current	V <sub>IN</sub> = 5.5 V or V <sub>OUT</sub> = 5.5 V	0	—	—	1.0	—	10	—	10	µA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = 5.5 V or GND	5.5	—	—	1.0	—	10	—	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.

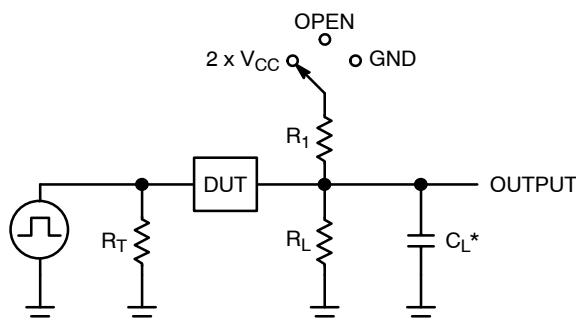
## AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			-40°C ≤ T <sub>A</sub> ≤ 85°C		-55°C ≤ T <sub>A</sub> ≤ 125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, (A or B or C) to Y (Figures 10 and 11)	R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 30 pF	1.65 to 1.95	–	8.6	14.4	–	14.4	–	14.4	ns
		R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 30 pF	2.3 to 2.7	–	5.1	8.3	–	8.3	–	8.3	
		R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF	3.0 to 3.6	–	3.9	6.3	–	6.3	–	6.3	
			4.5 to 5.5	–	3.3	5.1	–	5.1	–	5.1	

## CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Unit
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>	4.0	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> 10 MHz, V <sub>CC</sub> = 5.0 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub>	16 19.5	pF

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>.



$C_L$  includes probe and jig capacitance

$R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )

$f = 1$  MHz

Figure 10. 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

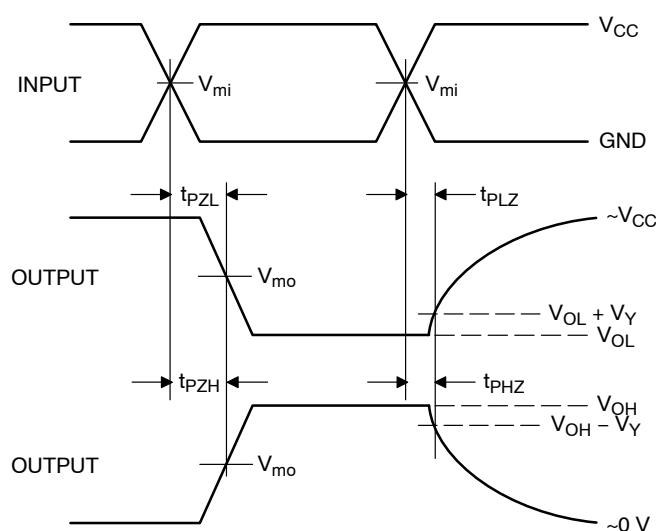
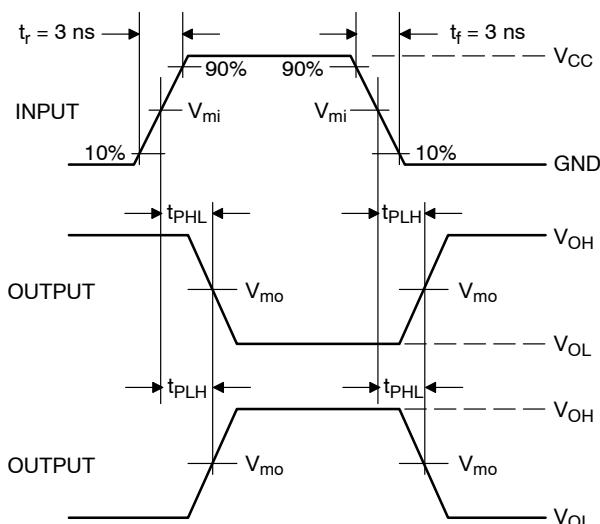


Figure 11. Switching Waveforms

$V_{CC}$ , 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

## ORDERING INFORMATION

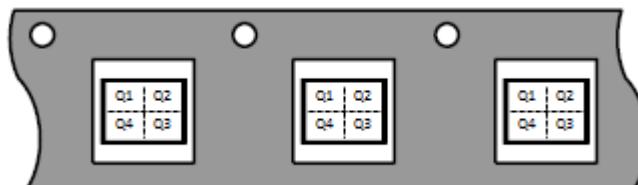
Device	Package	Specific Device Code	Pin 1 Orientation (See below)	Shipping <sup>†</sup>
NL7SZ98DFT2G	SC-88 (Pb-Free)	MP	Q4	3000 / Tape & Reel
NL7SZ98DFT2G-Q* (Please contact <b>onsemi</b> )	SC-88 (Pb-Free)	MP	Q4	3000 / Tape & Reel
NL7SZ98DBVT1G (Please contact <b>onsemi</b> )	SC-74 (Pb-Free)	AP	Q4	3000 / Tape & Reel
NL7SZ98MU1TCG (Please contact <b>onsemi</b> )	UDFN6, 1.45 x 1.0, 0.5P (Pb-Free)	TBD	Q4	3000 / Tape & Reel
NL7SZ98MU3TCG (Please contact <b>onsemi</b> )	UDFN6, 1.0 x 1.0, 0.35P (Pb-Free)	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.

\*-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

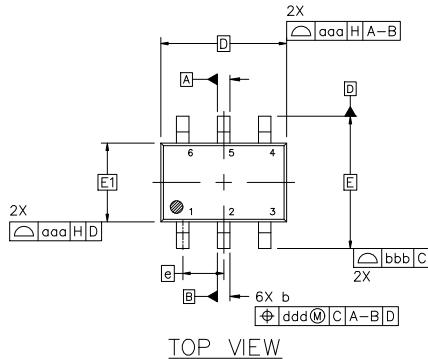


## PACKAGE DIMENSIONS

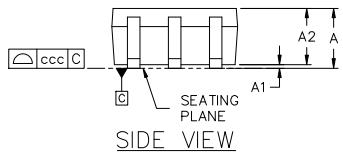
**SC-88 2.00x1.25x0.90, 0.65P**  
**CASE 419B-02**  
**ISSUE Z**

## NOTES:

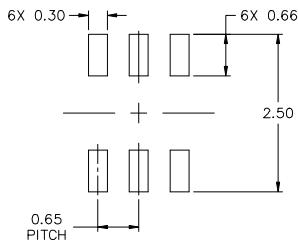
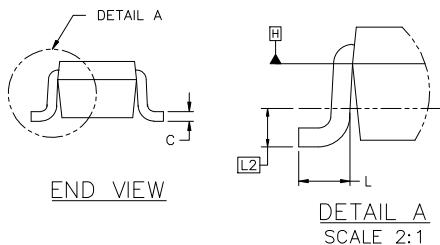
1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.



TOP VIEW



SIDE VIEW

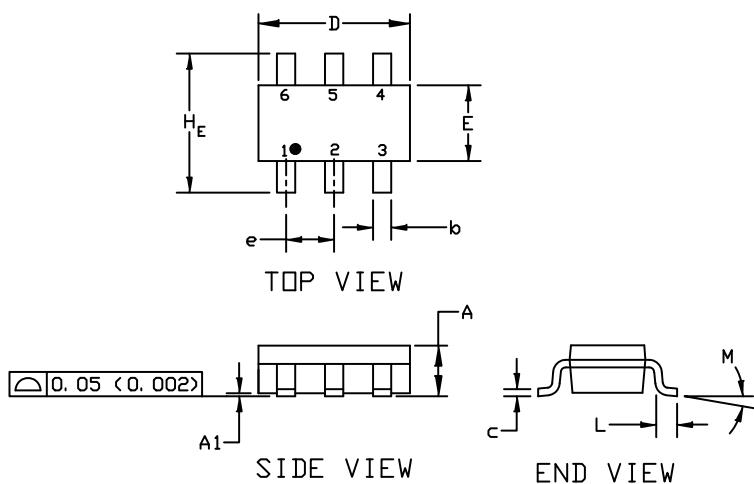


## RECOMMENDED MOUNTING FOOTPRINT\*

\* FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

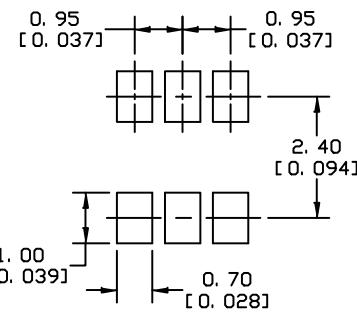
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	1.10
A1	0.00	---	0.10
A2	0.70	0.90	1.00
b	0.15	0.20	0.25
c	0.08	0.15	0.22
D	2.00 BSC		
E	2.10 BSC		
E1	1.25 BSC		
e	0.65 BSC		
L	0.26	0.36	0.46
L2	0.15 BSC		
aaa	0.15		
bbb	0.30		
ccc	0.10		
ddd	0.10		

## PACKAGE DIMENSIONS

SC-74  
CASE 318F  
ISSUE P

NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994  
 2. CONTROLLING DIMENSION: INCHES  
 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.

DIM	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.90	1.00	1.10	0.035	0.039	0.043
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.25	0.37	0.50	0.010	0.015	0.020
c	0.10	0.18	0.26	0.004	0.007	0.010
D	2.90	3.00	3.10	0.114	0.118	0.122
E	1.30	1.50	1.70	0.051	0.059	0.067
e	0.85	0.95	1.05	0.034	0.037	0.041
H <sub>E</sub>	2.50	2.75	3.00	0.099	0.108	0.118
L	0.20	0.40	0.60	0.008	0.016	0.024
M	0°	---	10°	0°	---	10°

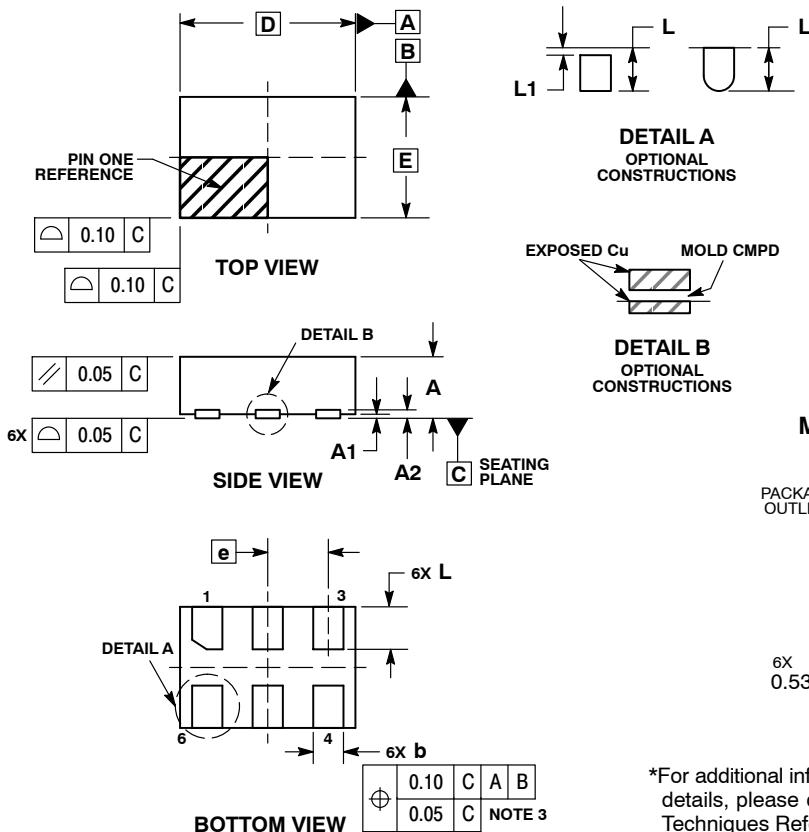


\* For additional information on our Pb-Free strategy and soldering details, please download the [DN Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D](#).

## SOLDERING FOOTPRINT

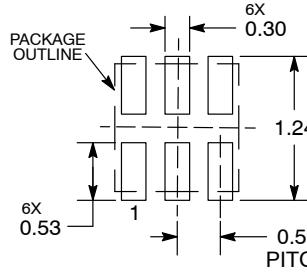
## PACKAGE DIMENSIONS

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



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

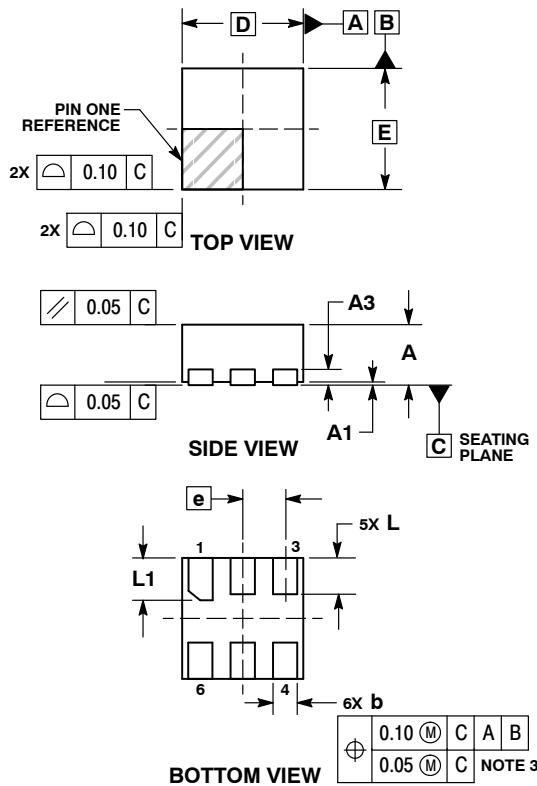
## MOUNTING FOOTPRINT



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.

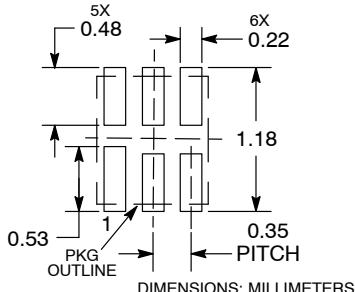
## PACKAGE DIMENSIONS

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	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 **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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