

# Triple Buffer

## NL37WZ16

The NL37WZ16 is a high performance triple buffer with inputs operating from a 1.65 V to 5.5 V supply.

### Features

- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation
- 2.4 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 US8, UDFN8 and UQFN8 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

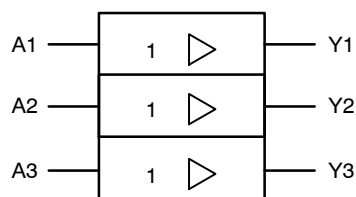
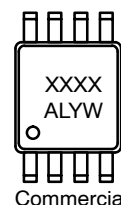


Figure 1. Logic Symbol

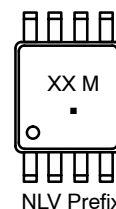
### MARKING DIAGRAMS



US8  
US SUFFIX  
CASE 493



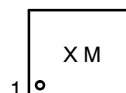
Commercial



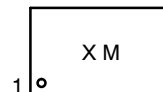
NLV Prefix



UDFN8, 1.45x1.0  
MU3 SUFFIX  
CASE 517BZ



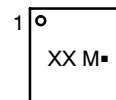
UDFN8, 1.95x1.0  
MU1 SUFFIX  
CASE 517CA



UQFN8, 1.4x1.2  
MQ2 SUFFIX  
CASE 523AS



UQFN8, 1.6x1.6  
MQ1 SUFFIX  
CASE 523AN



X, XX, XXXX = Specific Device Code  
A = Assembly Location  
L = Lot Code  
Y = Year Code  
W = Week Code  
M = Date Code  
▪ = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 6 of this data sheet.

NL37WZ16

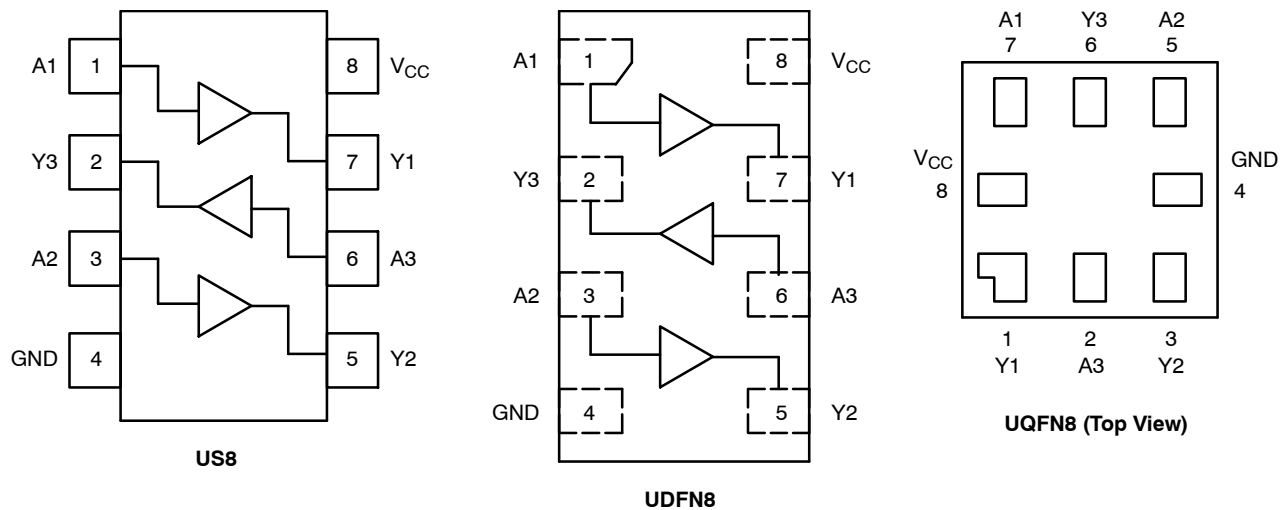


Figure 2. Pinout

PIN ASSIGNMENT

Pin	US8 / UDFN8	UQFN8
1	A1	Y1
2	Y3	A3
3	A2	Y2
4	GND	GND
5	Y2	A2
6	A3	Y3
7	Y1	A1
8	V <sub>CC</sub>	V <sub>CC</sub>

FUNCTION TABLE

A Input	Y Output
L	L
H	H

# MAXIMUM RATINGS

Symbol	Characteristics	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	−0.5 to +6.5	V
V <sub>IN</sub>	DC Input Voltage	−0.5 to +6.5	V
V <sub>OUT</sub>	DC Output Voltage 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	V
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
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) US8 UQFN8 UDFN8	250 210 231	°C/W
P <sub>D</sub>	Power Dissipation in Still Air US8 UQFN8 UDFN8	500 595 541	mW
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 1000	V
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.

# RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics	Min	Max	Unit
V <sub>CC</sub>	Positive DC Supply Voltage	1.65	5.5	V
V <sub>IN</sub>	DC Input Voltage	0	5.5	V
V <sub>OUT</sub>	DC Output Voltage Active-Mode (High or Low State) Tri-State Mode (Note 1) Power-Down Mode (V <sub>CC</sub> = 0 V)	0 0 0	V <sub>CC</sub> 5.5 5.5	V
T <sub>A</sub>	Operating Temperature Range	−55	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time V <sub>CC</sub> = 1.65 V to 1.95 V V <sub>CC</sub> = 2.3 V to 2.7 V V <sub>CC</sub> = 3.0 V to 3.6 V V <sub>CC</sub> = 4.5 V to 5.5 V	0 0 0 0	20 20 10 5	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			-55°C ≤ T <sub>A</sub> ≤ 125°C		Units
				Min	Typ	Max	Min	Max	
V <sub>IH</sub>	High-Level Input Voltage		1.65 to 1.95	0.65 V <sub>CC</sub>	–	–	0.65 V <sub>CC</sub>	–	V
			2.3 to 5.5	0.70 V <sub>CC</sub>	–	–	0.70 V <sub>CC</sub>	–	
V <sub>IL</sub>	Low-Level Input Voltage		1.65 to 1.95	–	–	0.35 V <sub>CC</sub>	–	0.35 V <sub>CC</sub>	V
			2.3 to 5.5	–	–	0.30 V <sub>CC</sub>	–	0.30 V <sub>CC</sub>	
V <sub>OH</sub>	High-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = –100 μA I <sub>OH</sub> = –4 mA I <sub>OH</sub> = –8 mA I <sub>OH</sub> = –12 mA I <sub>OH</sub> = –16 mA I <sub>OH</sub> = –24 mA I <sub>OH</sub> = –32 mA	1.65 to 5.5	V <sub>CC</sub> – 0.1	V <sub>CC</sub>	–	V <sub>CC</sub> – 0.1	–	V
			1.65	1.29	1.4	–	1.29	–	
			2.3	1.9	2.1	–	1.9	–	
			2.7	2.2	2.4	–	2.2	–	
			3.0	2.4	2.7	–	2.4	–	
			3.0	2.3	2.5	–	2.3	–	
			4.5	3.8	4.0	–	3.8	–	
V <sub>OL</sub>	Low-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 100 μA I <sub>OL</sub> = 4 mA I <sub>OL</sub> = 8 mA I <sub>OL</sub> = 12 mA I <sub>OL</sub> = 16 mA I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 32 mA	1.65 to 5.5	–	–	0.1	–	0.1	V
			1.65	–	0.08	0.24	–	0.24	
			2.3	–	0.2	0.3	–	0.3	
			2.7	–	0.22	0.4	–	0.4	
			3.0	–	0.28	0.4	–	0.4	
			3.0	–	0.38	0.55	–	0.55	
			4.5	–	0.42	0.55	–	0.55	
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	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	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> 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	V <sub>CC</sub> (V)	Test Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> = –55 to 125°C		Units
				Min	Typ	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay	1.8 ± 0.15	C <sub>L</sub> = 15 pF R <sub>D</sub> = 1 MΩ R <sub>1</sub> = Open	–	6.0	7.9	–	8.8	ns
		2.5 ± 0.2		–	3.0	5.2	–	5.8	
		3.3 ± 0.3		–	2.3	3.6	–	4.0	
		5.0 ± 0.5		–	1.8	2.9	–	3.2	
		3.3 ± 0.3	C <sub>L</sub> = 50 pF, R <sub>D</sub> = 500 Ω, R <sub>1</sub> = Open	–	3.0	4.6	–	5.1	
		5.0 ± 0.5		–	2.4	3.8	–	4.2	

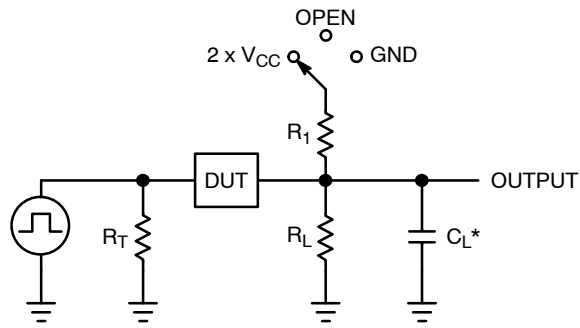
5. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>/2 (per flip-flop). 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>.

## 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 6)	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> = 5.5 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub>	9 11	pF

6. 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>.

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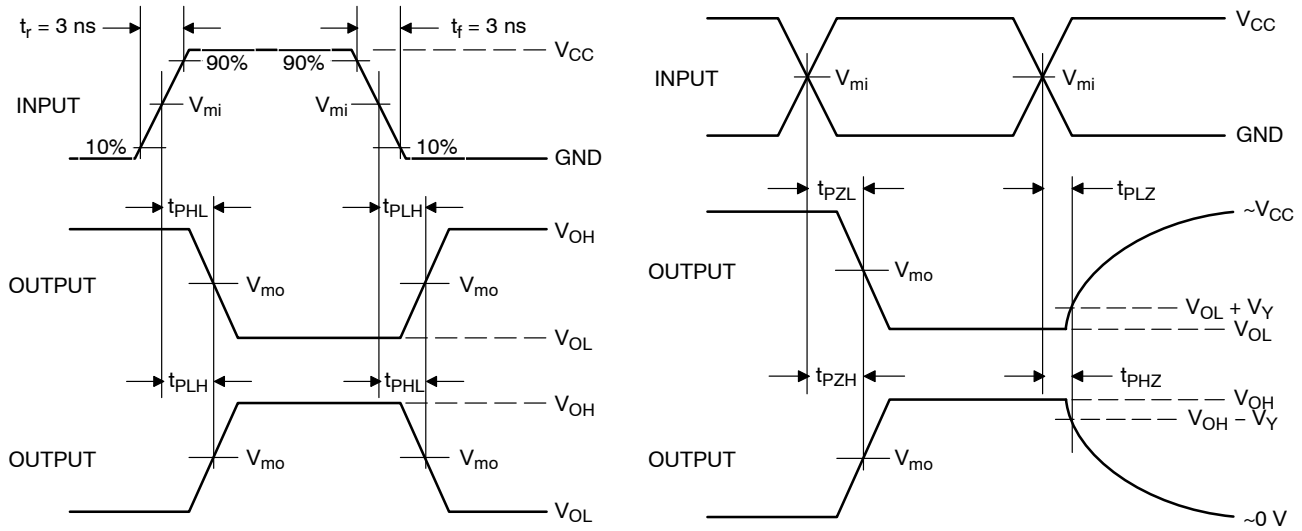


$C_L$  includes probe and jig capacitance  
 $R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )  
 $f = 1$  MHz

**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
		$t_{PLH}, t_{PHL}$	$t_{PLZ}, t_{PZL}, t_{PHZ}, t_{PZH}$	
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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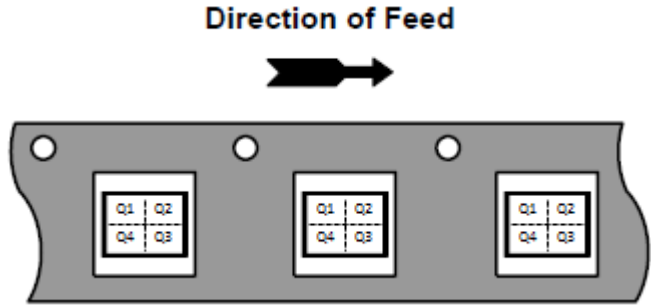
## DEVICE ORDERING INFORMATION

Device	Packages	Specific Device Code	Pin 1 Orientation (See below)	Shipping <sup>†</sup>
NL37WZ16USG	US8	LR	Q4	3000 / Tape & Reel
NL37WZ16USG-Q* (Contact <b>onsemi</b> )	US8	LR	Q4	3000 / Tape & Reel
NL37WZ16MQ1TCG (Contact <b>onsemi</b> )	UQFN8, 1.6 x 1.6, 0.5P	TBD	TBD	3000 / Tape & Reel
NL37WZ16MU1TCG (Contact <b>onsemi</b> )	UDFN8, 1.95 x 1.0, 0.5P	AC	Q4	3000 / Tape & Reel
NL37WZ16MU2TCG (Contact <b>onsemi</b> )	UDFN8, 1.6 x 1.0, 0.4P	AE	Q4	3000 / Tape & Reel
NL37WZ16MU3TCG (Contact <b>onsemi</b> )	UDFN8, 1.45 x 1.0, 0.35P	E	Q4	3000 / Tape & Reel
NL37WZ16MQ2TCG (Contact <b>onsemi</b> )	UQFN8, 1.4 x 1.2, 0.4P	TBD	TBD	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-Q100 Qualified and PPAP Capable.

## PIN 1 ORIENTATION IN TAPE AND REEL



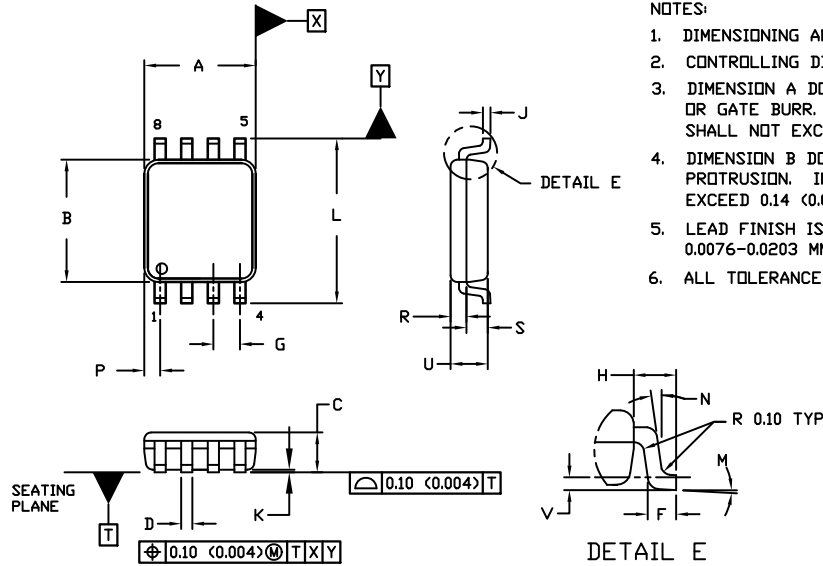
# NL37WZ16

## PACKAGE DIMENSIONS

**US8**  
CASE 493  
ISSUE F

### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSION, OR GATE BURR. MOLD FLASH, PROTRUSION, OR GATE BURR SHALL NOT EXCEED 0.14 (0.0055") PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH AND PROTRUSION SHALL NOT EXCEED 0.14 (0.0055") PER SIDE.
5. LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076-0.0203 MM (0.003-0.008").
6. ALL TOLERANCE UNLESS OTHERWISE SPECIFIED  $\pm 0.0508$  MM (0.002").



DIM	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	1.90	2.10	0.075	0.083
B	2.20	2.40	0.087	0.094
C	0.60	0.90	0.024	0.035
D	0.17	0.25	0.007	0.010
F	0.20	0.35	0.008	0.014
G	0.50 BSC		0.020 BSC	
H	0.40 REF		0.016 REF	
J	0.10	0.18	0.004	0.007
K	0.00	0.10	0.000	0.004
L	3.00	3.25	0.118	0.128
M	0°	6°	0°	6°
N	0°	10°	0°	10°
P	0.23	0.34	0.010	0.013
R	0.23	0.33	0.009	0.013
S	0.37	0.47	0.015	0.019
U	0.60	0.80	0.024	0.031
V	0.12 BSC		0.005 BSC	

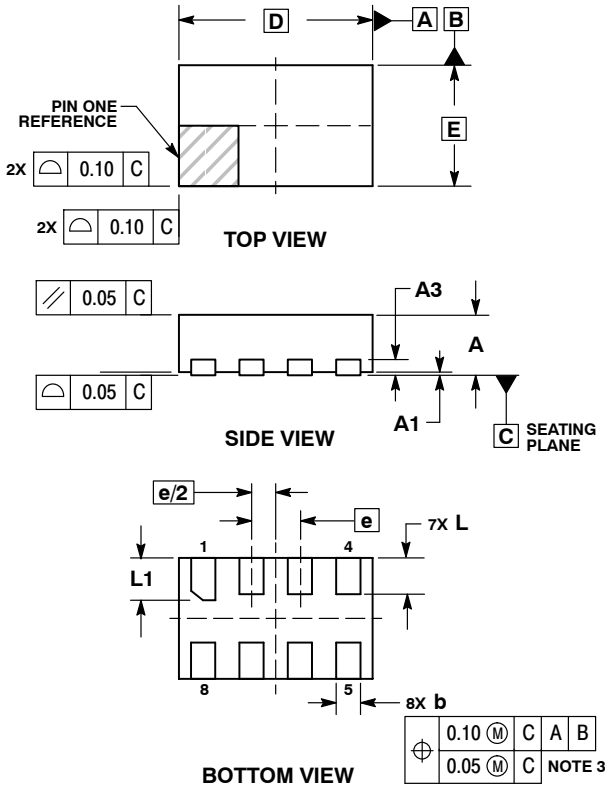
### RECOMMENDED \* MOUNTING FOOTPRINT

\* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDER99/0.

# NL37WZ16

## PACKAGE DIMENSIONS

UDFN8, 1.6x1, 0.4P  
CASE 517BY  
ISSUE O

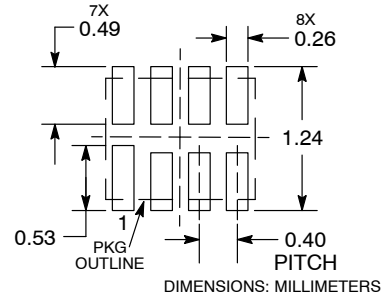


### NOTES:

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	0.15	0.25
D	1.60	BSC
E	1.00	BSC
e	0.40	BSC
L	0.25	0.35
L1	0.30	0.40

### RECOMMENDED SOLDERING FOOTPRINT\*



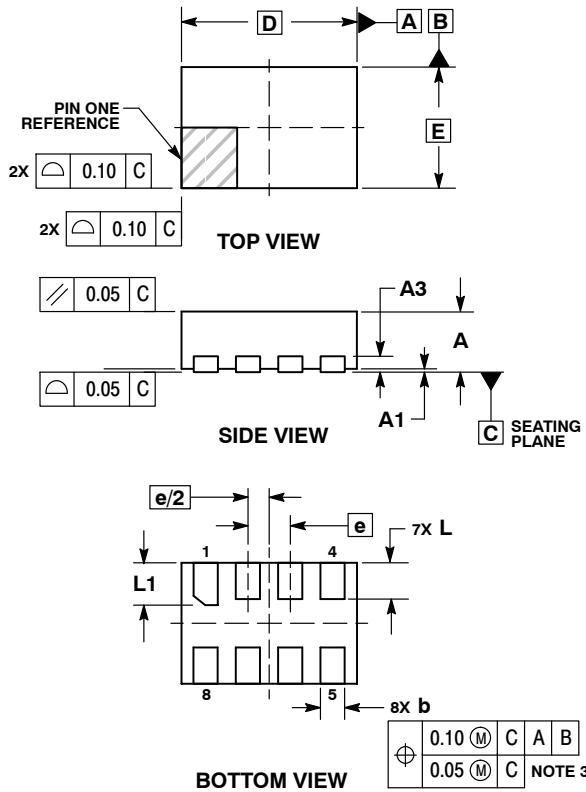
\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



# NL37WZ16

## PACKAGE DIMENSIONS

UDFN8, 1.45x1, 0.35P  
CASE 517BZ  
ISSUE O

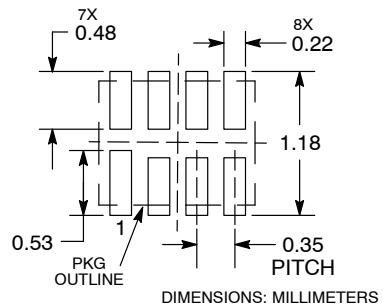


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2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP.
4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

DIM	MILLIMETERS	
	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13 REF	
b	0.15	0.25
D	1.45 BSC	
E	1.00 BSC	
e	0.35 BSC	
L	0.25	0.35
L1	0.30	0.40

### RECOMMENDED SOLDERING FOOTPRINT\*

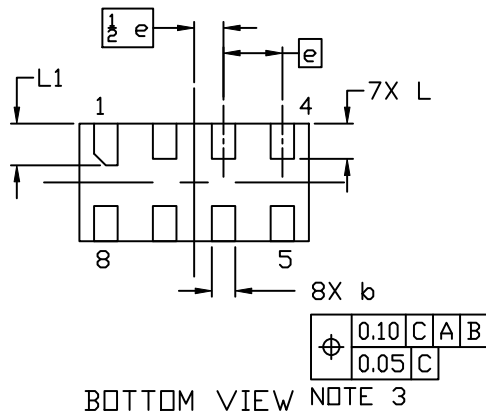
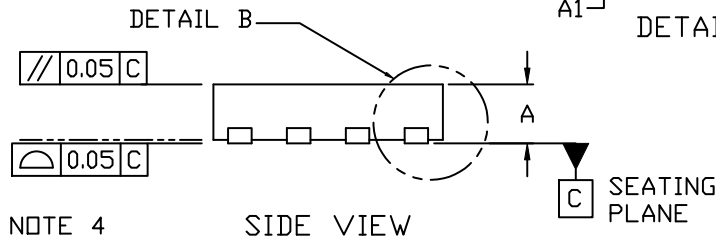
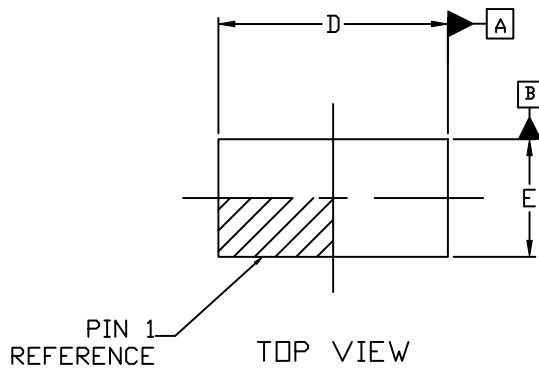


\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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## PACKAGE DIMENSIONS

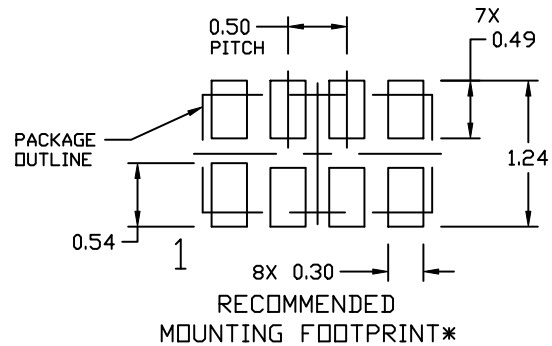
UDFN8, 1.95x1.0, 0.5P  
CASE 517CA  
ISSUE A



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO ALL THE TERMINALS.
5. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.45	0.50	0.55
A1	0.00	---	0.05
A3	0.13 REF		
b	0.15	0.20	0.25
D	1.85	1.95	2.05
E	0.90	1.00	1.10
e	0.50 BSC		
L	0.25	0.30	0.35
L1	0.30	0.35	0.40

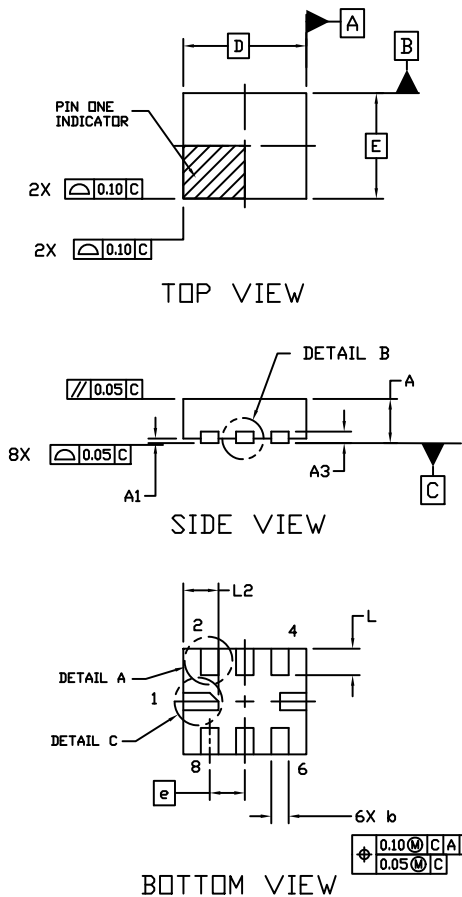


\* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# NL37WZ16

## PACKAGE DIMENSIONS

UQFN8, 1.40x1.20, 0.40P  
CASE 523AS  
ISSUE B



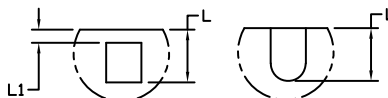
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1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.25MM FROM THE TERMINAL TIP.
4. REFER TO SPECIFIC DEVICE DATA SHEET FOR PIN 1 NOTCH LOCATION.

EXPOSED Cu

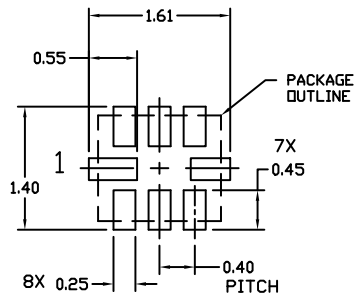
MOLD CMPD

**DETAIL B**  
ALTERNATE CONSTRUCTION



DIM	MILLIMETERS	
	MIN.	MAX.
A	0.45	0.55
A1	0.00	0.05
A3	0.13	REF
b	0.15	0.25
D	1.40	BSC
E	1.20	BSC
e	0.40	BSC
L	0.20	0.40
L1	---	0.15
L2	0.30	0.50

**DETAIL C**  
ALTERNATE CONSTRUCTION  
NOTE 4



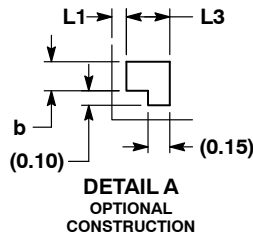
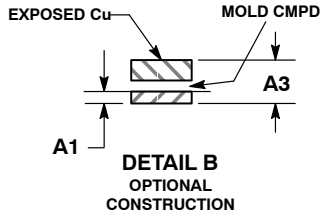
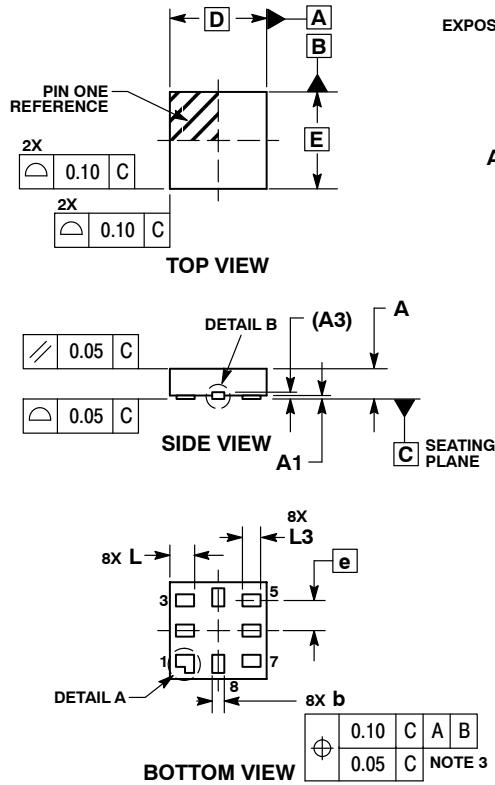
**RECOMMENDED  
MOUNTING FOOTPRINT \***

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

# NL37WZ16

## PACKAGE DIMENSIONS

UQFN8, 1.6x1.6, 0.5P  
CASE 523AN  
ISSUE O

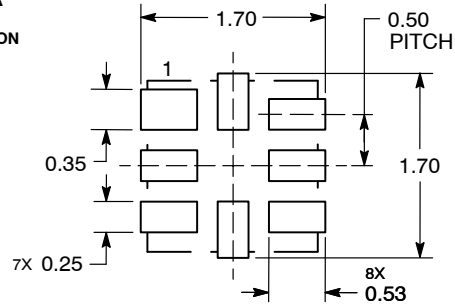


### NOTES:

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	MIN	MAX
A	0.45	0.60
A1	0.00	0.05
A3	0.13	REF
b	0.15	0.25
D	1.60	BSC
E	1.60	BSC
e	0.50	BSC
L	0.35	0.45
L1	---	0.15
L3	0.25	0.35

### 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.

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