Triple Noninverting Schmitt-Trigger Buffer

NL37WZ17

The NL37WZ17 is a high performance triple buffer with Schmitt−Trigger 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
- 3.2 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
- Source/Sink 24 mA at 3.0 V
- Available in US8, UDFN8 and UQFN8 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
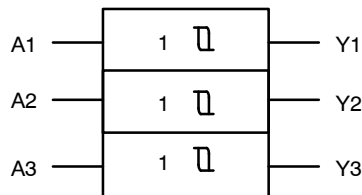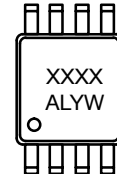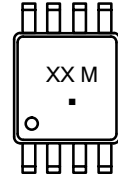- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant
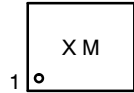
MARKING DIAGRAMS
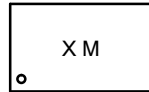

US8
US SUFFIX
CASE 493

XXXX
ALYW
Commercial

XX M
.
NLV Prefix

UDFN8, 1.45x1.0
MU3 SUFFIX
CASE 517BZ

X M
1

UDFN8, 1.95x1.0
MU1 SUFFIX
CASE 517CA

X M
1

UQFN8, 1.4x1.2
MQ2 SUFFIX
CASE 523AS

XM
1
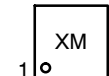
UQFN8, 1.6x1.6
MQ1 SUFFIX
CASE 523AN

1
XX M■

1   8
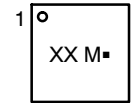
X, XX, XXXX	= Specific Device Code
A	= Assembly Location
L	= Lot Code
Y	= Year Code
W	= Week Code
M	= Date Code
■	= Pb−Free Package

Figure 1. Logic Symbol

ORDERING INFORMATION

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

NL37WZ17
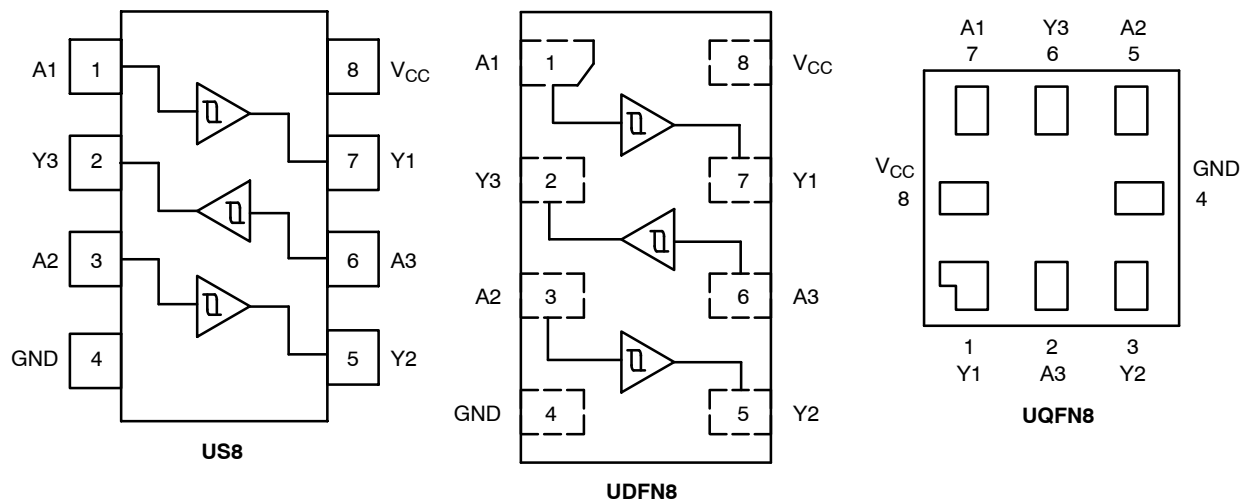
Figure 2. Pinout

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_{CC}	V_{CC}

FUNCTION TABLE

A Input	Y Output
L	L
H	H

MAXIMUM RATINGS

Symbol	Characteristics		Value	Unit
V_{CC}	DC Supply Voltage	NLV	−0.5 to +7.0 −0.5 to +6.5	V
V_{IN}	DC Input Voltage	NLV	−0.5 to +7.0 −0.5 to +6.5	V
V_{OUT}	DC Output Voltage (NLV)	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 +7.0 −0.5 to +7.0	V
	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	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)	US8 UQFN8 UDFN	250 210 231	°C/W
P_D	Power Dissipation in Still Air	US8 UQFN8 UDFN8	500 595 541	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	V
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	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_CC (V)	T_A = 25°C			−55°C ≤ T_A ≤ 125°C		Units
				Min	Typ	Max	Min	Max	
V_{T+}	Positive Input Threshold Voltage (NLV)		1.65	0.6	1.0	1.4	0.6	1.4	V
			2.3	1.0	1.5	1.8	1.0	1.8	
			2.7	1.2	1.7	2.0	1.2	2.0	
			3.0	1.3	1.9	2.2	1.3	2.2	
			4.5	1.9	2.7	3.1	1.9	3.1	
			5.5	2.2	3.3	3.6	2.2	3.6	
	Positive Input Threshold Voltage		1.65	–	1.0	1.4	–	1.4	V
			2.3	–	1.5	1.8	–	1.8	
			2.7	–	1.7	2.0	–	2.0	
			3.0	–	1.9	2.2	–	2.2	
			4.5	–	2.7	3.1	–	3.1	
			5.5	–	3.3	3.6	–	3.6	
V_{T-}	Negative Input Threshold Voltage (NLV)		1.65	0.2	0.5	0.8	0.2	0.8	V
			2.3	0.4	0.75	1.15	0.4	1.15	
			2.7	0.5	0.87	1.4	0.5	1.4	
			3.0	0.6	1.0	1.5	0.6	1.5	
			4.5	1.0	1.5	2.0	1.0	2.0	
			5.5	1.2	1.9	2.3	1.2	2.3	
	Negative Input Threshold Voltage		1.65	0.2	0.5	–	0.2	–	V
			2.3	0.4	0.75	–	0.4	–	
			2.7	0.5	0.87	–	0.5	–	
			3.0	0.6	1.0	–	0.6	–	
			4.5	1.0	1.5	–	1.0	–	
			5.5	1.2	1.9	–	1.2	–	
V_H	Input Hysteresis Voltage		1.65	0.15	0.52	1.0	0.15	1.0	V
			2.3	0.25	0.75	1.1	0.25	1.1	
			2.7	0.3	0.83	1.15	0.3	1.15	
			3.0	0.4	0.93	1.2	0.4	1.2	
			4.5	0.6	1.2	1.5	0.6	1.5	
			5.5	0.7	1.4	1.7	0.7	1.7	
V_{OH}	High−Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $I_{OH} = -100\ \mu A$ $I_{OH} = -4$ 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} $I_{OL} = 100\ \mu A$ $I_{OL} = 4$ 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	–	–	±0.1	–	±1.0	μA

NL37WZ17

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	V_{CC} (V)	$T_A = 25°C$ Min	Typ	Max	$-55°C \leq T_A \leq 125°C$ Min	Max	Units
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

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_{CC} (V)	Test Conditions	$T_A = 25°C$ Min	Typ	Max	$T_A = -55$ to $125°C$ Min	Max	Units
t_{PLH}, t_{PHL}	Propagation Delay	1.85 ± 0.15	$C_L = 15$ pF $R_D = 1$ MΩ $R_1 =$ Open	–	6.8	9.2	–	9.2	ns
		2.5 ± 0.2		–	4.3	7.4	–	8.1	
		3.3 ± 0.3		–	3.3	5.0	–	7.0	
		5.0 ± 0.5		–	2.7	4.1	–	4.5	
		3.3 ± 0.3	$C_L = 50$ pF, $R_D = 500$ Ω, $R_1 =$ Open	–	4.0	5.0	–	6.6	
		5.0 ± 0.5		–	3.2	4.9	–	5.4	

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}	2.5	pF
C_{PD}	Power Dissipation Capacitance (Note 5)	10 MHz, $V_{CC} = 3.3$ V, $V_{IN} = 0$ V or V_{CC} 10 MHz, $V_{CC} = 5.5$ V, $V_{IN} = 0$ V or V_{CC}	9 11	pF

5. C_{PD} 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: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. C_{PD} is used to determine the no–load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.
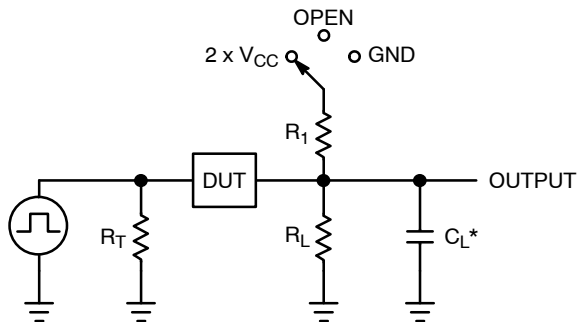
C_L includes probe and jig capacitance
R_T is Z_{OUT} of pulse generator (typically 50 Ω)
f = 1 MHz

Figure 3. Test Circuit

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
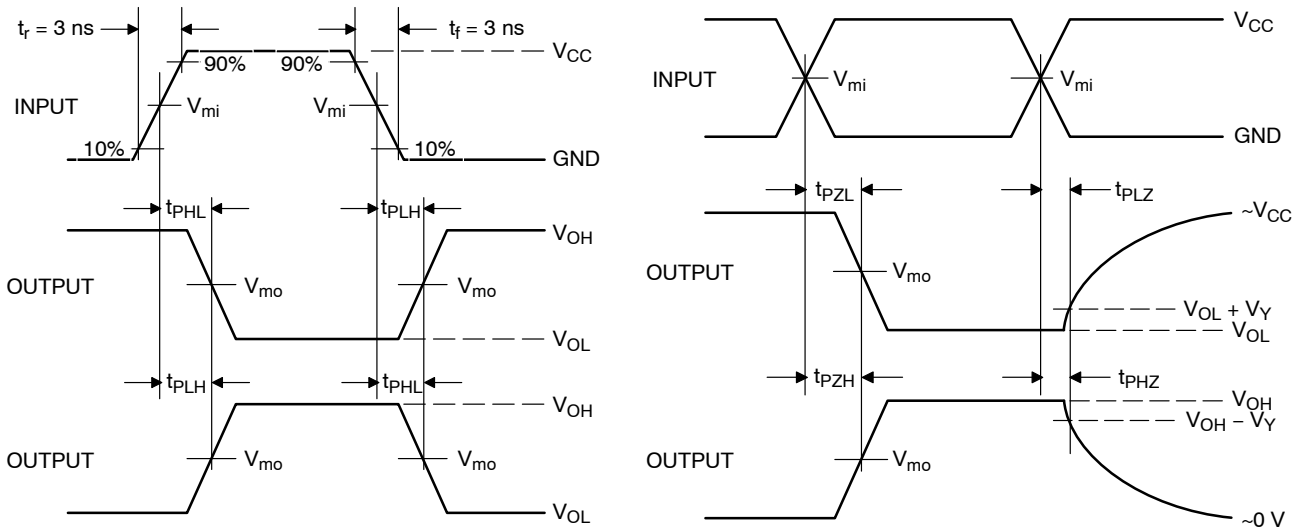
Figure 4. Switching Waveforms

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†
NL37WZ17USG	US8	LX	Q4	3000 / Tape & Reel
NL37WZ17USG−L22190**	US8	LX	Q4	3000 / Tape & Reel
NLV37WZ17USG*	US8	LX	Q4	3000 / Tape & Reel
NL37WZ17MQ1TCG (In Development)	UQFN8, 1.6 x 1.6, 0.5P	TBD	TBD	3000 / Tape & Reel
NL37WZ17MU1TCG (In Development)	UDFN8, 1.95 x 1.0, 0.5P	TBD	Q4	3000 / Tape & Reel
NL37WZ17MU3TCG (In Development)	UDFN8, 1.45 x 1.0, 0.35P	2	Q4	3000 / Tape & Reel
NL37WZ17MQ2TCG (In Development)	UQFN8, 1.4 x 1.2, 0.4P	TBD	TBD	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.
*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable.
**Please refer to NLV specifications for this device.

Pin 1 Orientation in Tape and Reel
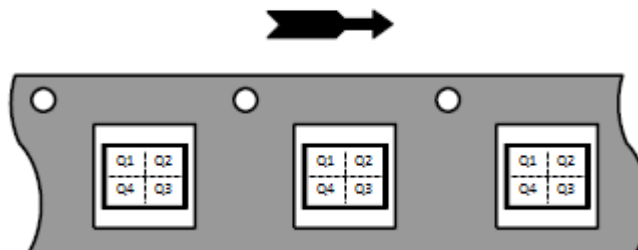
NL37WZ17

PACKAGE DIMENSIONS

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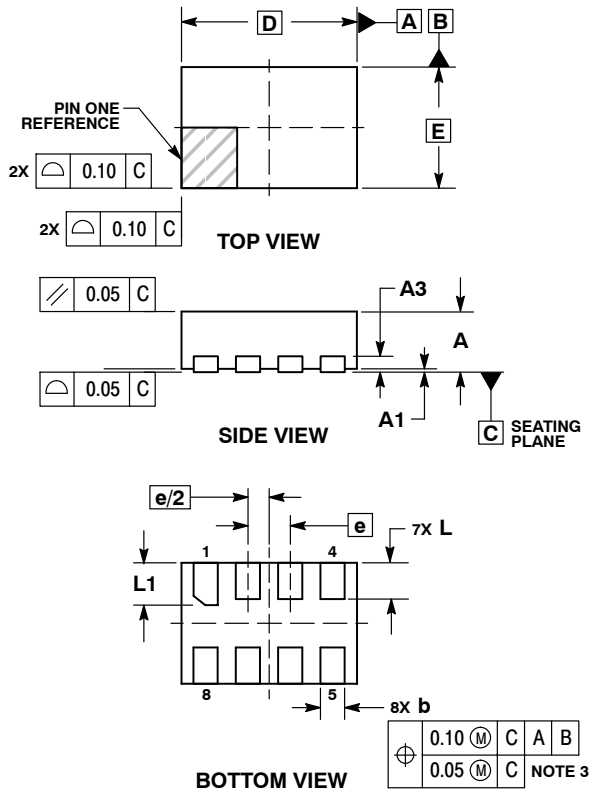
TOP VIEW

2X ⌓ 0.10 C

2X ⌓ 0.10 C

PIN ONE REFERENCE

D | A B
E

SIDE VIEW

⌸ 0.05 C

⌓ 0.05 C

A3
A
A1
C SEATING PLANE

BOTTOM VIEW

e/2
e
7X L
L1
1   4
8   5
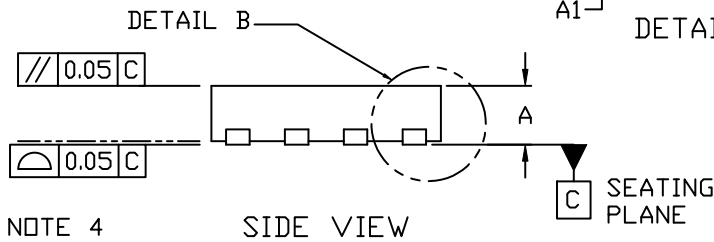8X b
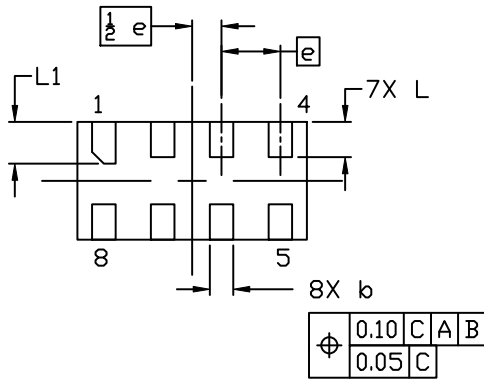
| ⌖ | 0.10 Ⓜ | C A B |
| | 0.05 Ⓜ | C | NOTE 3 |

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	0.15	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*
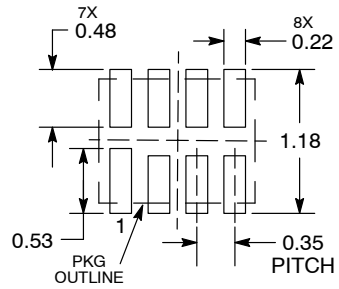
7X
0.48
8X
0.22
1.18
0.53
1
0.35 PITCH
PKG OUTLINE

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.

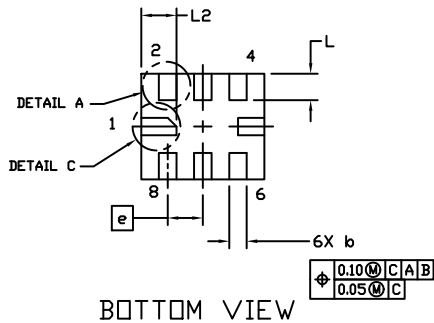# NL37WZ17

PACKAGE DIMENSIONS

UDFN8, 1.95x1, 0.5P
CASE 517CA
ISSUE A
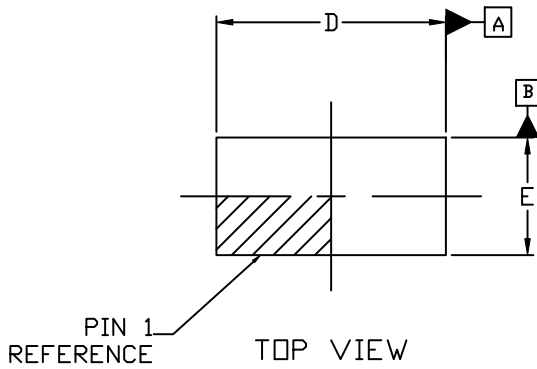
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO TO ALL THE TERMINALS.
5. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.
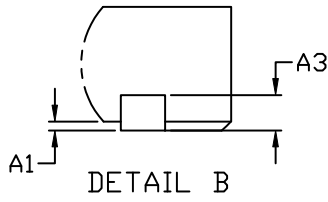
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.45	0.50	0.55
A1	0.00	---	0.05
A3	0.13 REF		
b	0.15	0.20	0.25
D	1.85	1.95	2.05
E	0.90	1.00	1.10
e	0.50 BSC		
L	0.25	0.30	0.35
L1	0.30	0.35	0.40
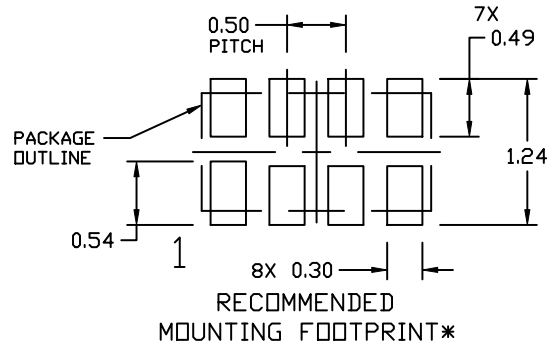
PIN 1 REFERENCE

TOP VIEW

DETAIL B

A3

A1

DETAIL B

⫽ 0.05 C

⌒ 0.05 C

NOTE 4

SIDE VIEW

A

C SEATING PLANE

1 2 e

L1

e

7X L

1   4

8   5

8X b

⊕ 0.10 C A B
0.05 C

BOTTOM VIEW NOTE 3

0.50 PITCH

7X 0.49

PACKAGE OUTLINE

1.24

0.54

1

8X 0.30

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.

PACKAGE DIMENSIONS

UQFN8, 1.4x1.2, 0.4P
CASE 523AS
ISSUE B

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 0.25MM FROM THE TERMINAL TIP.

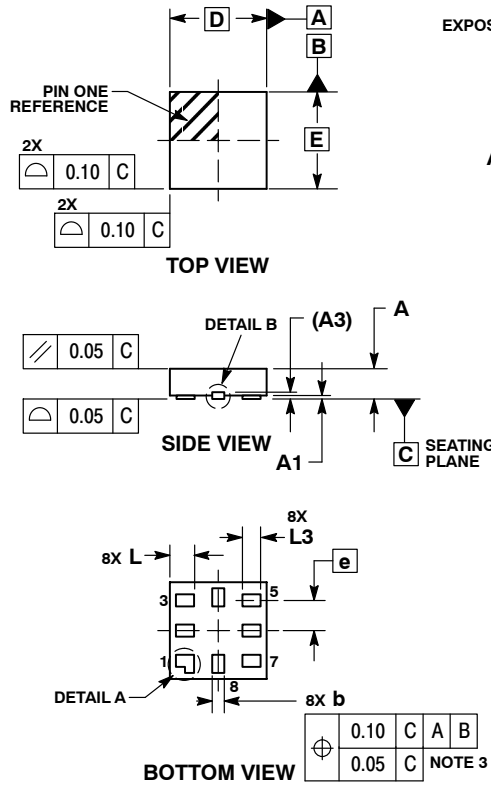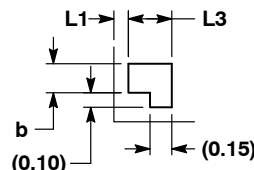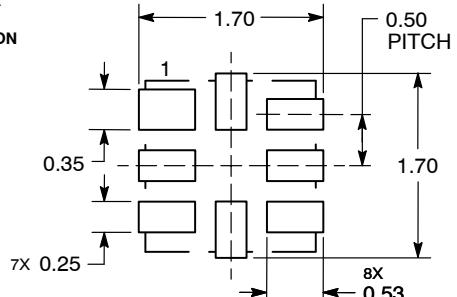4. REFER TO SPECIFIC DEVICE DATA SHEET FOR PIN 1 NOTCH LOCATION.

PIN ONE INDICATOR

2X ⌁ 0.10 C

2X ⌁ 0.10 C

TOP VIEW

DETAIL B

∥ 0.05 C

8X ⌁ 0.05 C

A1

A3

SEATING PLANE

SIDE VIEW

EXPOSED Cu   MOLD CMPD
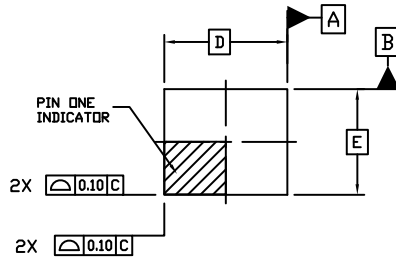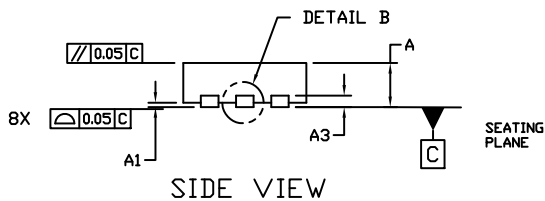
DETAIL B
ALTERNATE CONSTRUCTION

L1

L

L
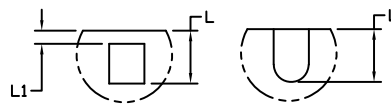
DETAIL A
ALTERNATE CONSTRUCTIONS

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

L2

2   4

DETAIL A

1

DETAIL C

8   6

e

6X b

⊕ 0.10 Ⓜ C A B
  0.05 Ⓜ C

BOTTOM VIEW

DETAIL C
ALTERNATE CONSTRUCTION
NOTE 4

1.61

0.55

1.40

1

PACKAGE OUTLINE

7X 0.45

8X 0.25   0.40 PITCH

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.

NL37WZ17

PACKAGE DIMENSIONS

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

TOP VIEW

PIN ONE REFERENCE

2X | 0.10 | C

2X | 0.10 | C

D | A
B
E
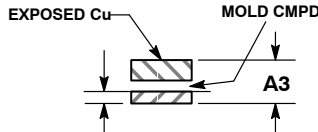
DETAIL B
OPTIONAL CONSTRUCTION

EXPOSED Cu   MOLD CMPD

A3
A1

SIDE VIEW

0.05 | C

0.05 | C

DETAIL B   (A3)   A

A1

C SEATING PLANE

DETAIL A
OPTIONAL CONSTRUCTION

L1   L3

b

(0.10)   (0.15)

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	0.60
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

BOTTOM VIEW

8X L

8X L3

e

3 5
1 7
8

DETAIL A

8X b

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

SOLDERING FOOTPRINT*

1.70

0.50 PITCH

1

0.35

1.70

7X 0.25

8X 0.53

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.

onsemi

US8
CASE 493
ISSUE F

SCALE 4 :1

DATE 01 SEP 2021
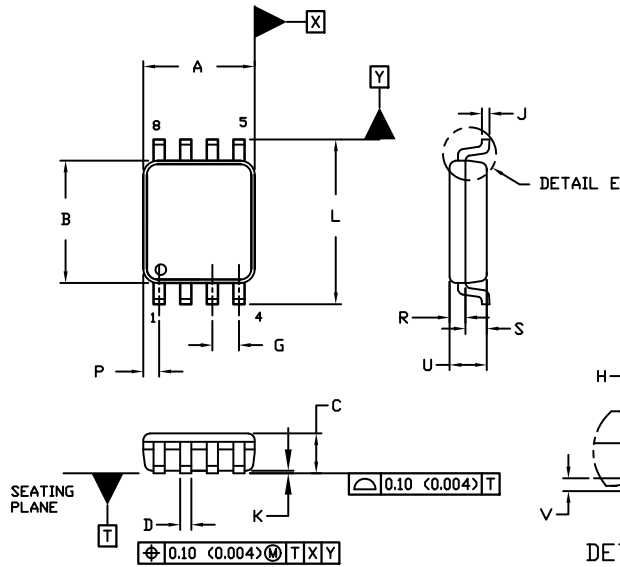
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSION, OR GATE BURR. MOLD FLASH, PROTRUSION, OR GATE BURR SHALL NOT EXCEED 0.14 (0.0055") PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. 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 ±0.0508 MM (0.002").

DETAIL E

SEATING PLANE

⌴ 0.10 (0.004) T

⊕ 0.10 (0.004) Ⓜ T X Y

DETAIL E

R 0.10 TYP

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	
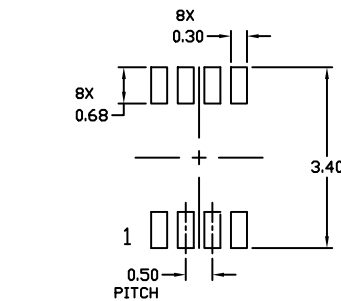
8X 0.30

8X 0.68

3.40

0.50 PITCH

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.

GENERIC MARKING DIAGRAM*

XX M∎
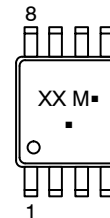
XX = Specific Device Code
M = Date Code
∎ = Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "∎", may or may not be present. Some products may not follow the Generic Marking.

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