

Triple Inverter

NL37WZ04

The NL37WZ04 is a high performance triple inverter operating from a 1.65 V to 5.5 V supply.

Features

- Designed for 1.65 V to 5.5 V V_{CC} Operation
- 2.3 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

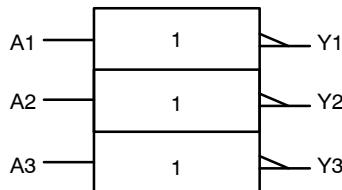
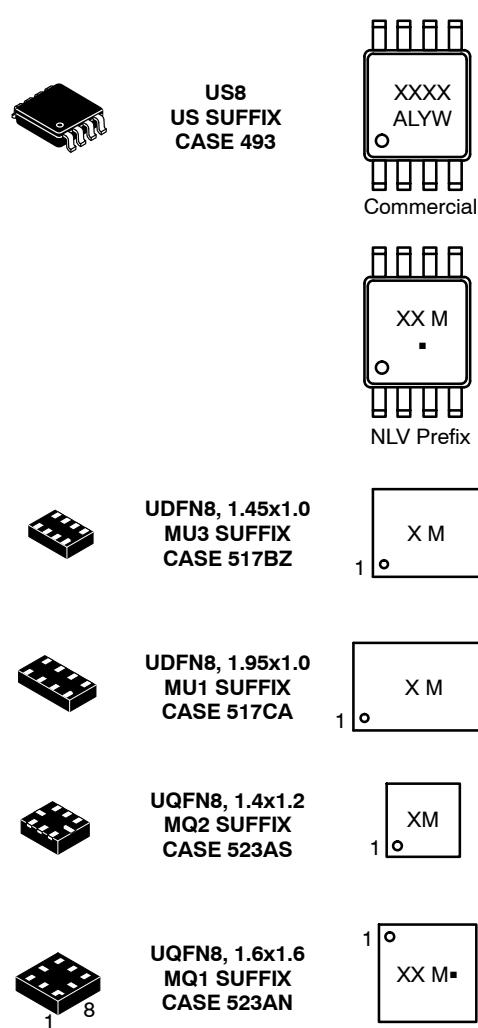


Figure 1. Logic Symbol

MARKING DIAGRAMS



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 in the package dimensions section on page 6 of this data sheet.

NL37WZ04

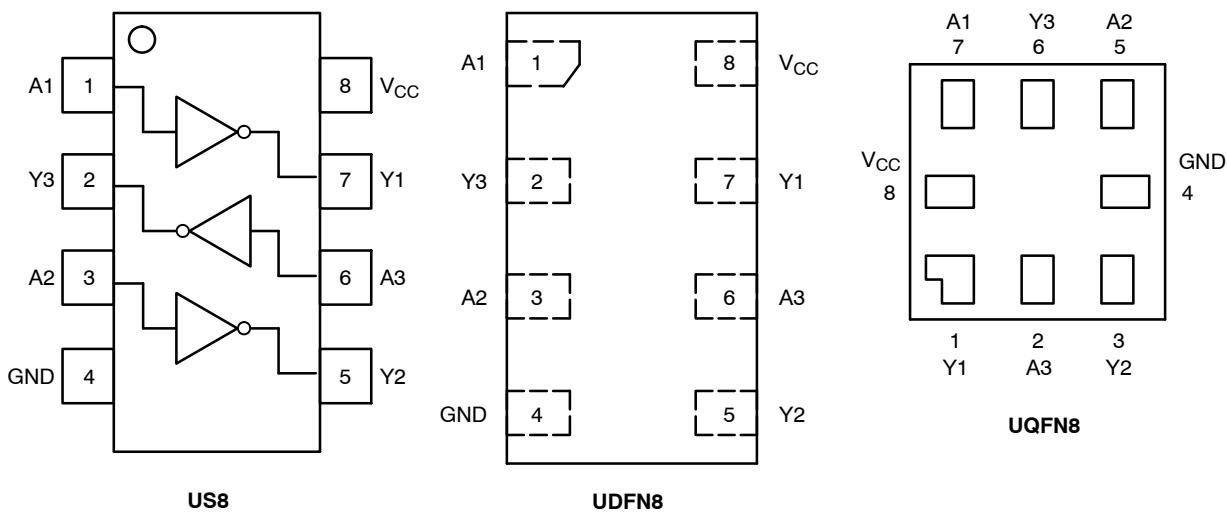


Figure 2. Pinout

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	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)	US8 UQFN8 UDFN8 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	
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/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 _{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 _{OH}	High-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OH} = -100 µA 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 1.4 2.1 2.2 2.4 2.7 3.8	V _{CC} – – – – – – –	– – – – – – – –	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 µA 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
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

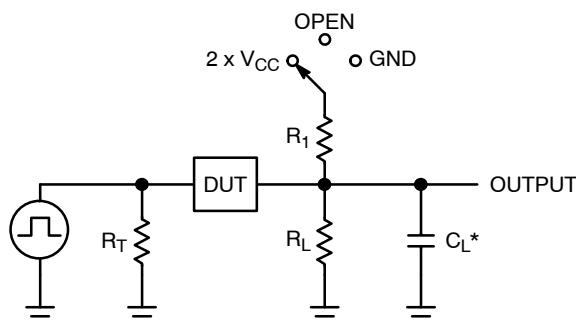
Symbol	Parameter	V _{CC} (V)	Test Conditions	T _A = 25°C			T _A = -55 to 125°C		Units
				Min	Typ	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation Delay, A to Y	1.65 to 1.95	C _L = 15 pF R _L = 1 MΩ R ₁ = Open	–	4.4	9.5	–	10.0	ns
		2.3 to 2.7		–	5.0	5.7	–	6.1	
		3.0 to 3.6		–	2.2	3.4	–	3.8	
		4.5 to 5.5		–	1.8	2.8	–	3.1	
		3.0 to 3.6	C _L = 50 pF, R _L = 500 Ω, R ₁ = Open	–	3.9	4.5	–	5.0	
		4.5 to 5.5		–	2.3	3.6	–	4.0	

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} • V_{CC} • f_{in} + I_{CC}/2 (per flip-flop). C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

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 6)	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

6. 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} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption; P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • 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}	$2 \times V_{CC}$	50	500	500
t_{PHZ} / t_{PZH}	GND	50	500	500

X = Don't Care

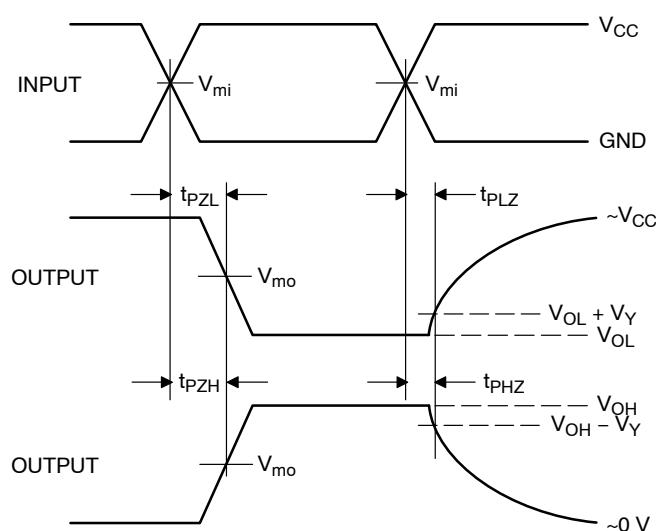
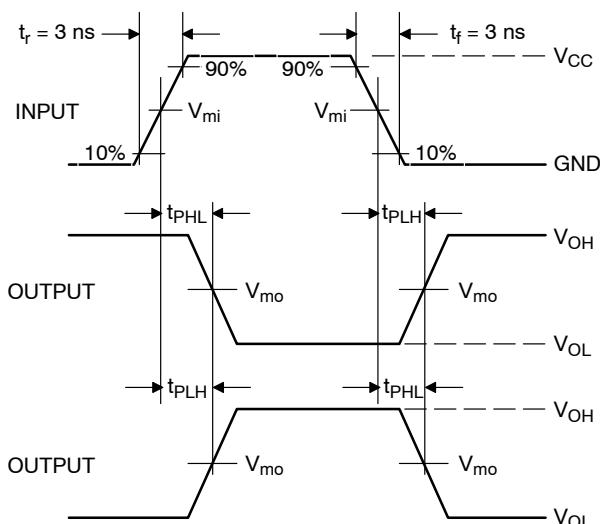


Figure 4. Switching Waveforms

V_{CC} , V	V_{mi} , V	V_{mo} , V		V_Y , V
		t_{PLH}, t_{PHL}	$t_{PZL}, t_{PLZ}, t_{PZH}, t_{PHZ}$	
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

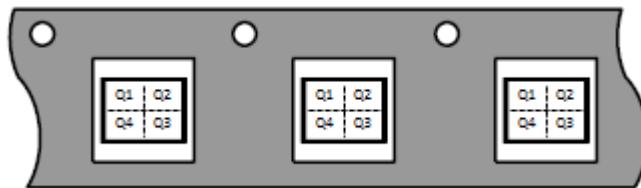
Device	Packages	Specific Device Code	Pin 1 Orientation (See below)	Shipping [†]
NL37WZ04USG	US8	L5	Q4	3000 / Tape & Reel
NL37WZ04USG-Q* (Please contact onsemi)	US8	L5	Q4	3000 / Tape & Reel
NL37WZ04MQ1TCG (Please contact onsemi)	UQFN8, 1.6 x 1.6, 0.5P	TBD	TBD	3000 / Tape & Reel
NL37WZ04MU1TCG (Please contact onsemi)	UDFN8, 1.95 x 1.0, 0.5P	TBD	TBD	3000 / Tape & Reel
NL37WZ04MU3TCG (Please contact onsemi)	UDFN8, 1.45 x 1.0, 0.35P	TBD	TBD	3000 / Tape & Reel
NL37WZ04MQ2TCG (Please contact onsemi)	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.

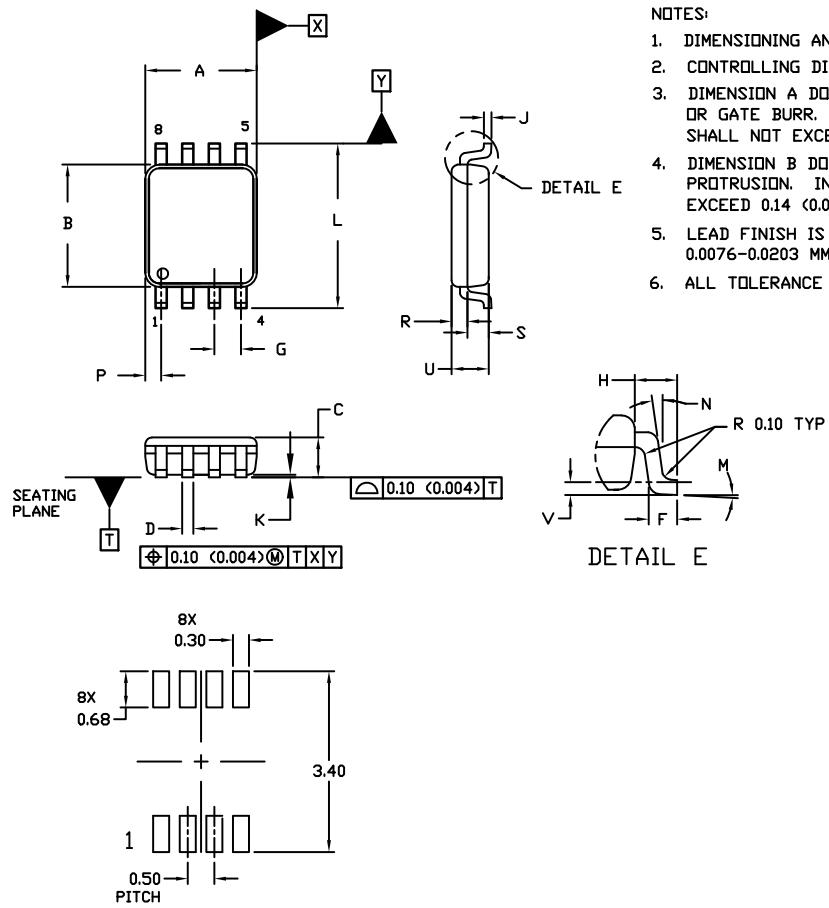
*-Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

PIN 1 ORIENTATION IN TAPE AND REEL

Direction of Feed



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 ± 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

* For additional information on our Pb-Free

strategy and soldering details, please

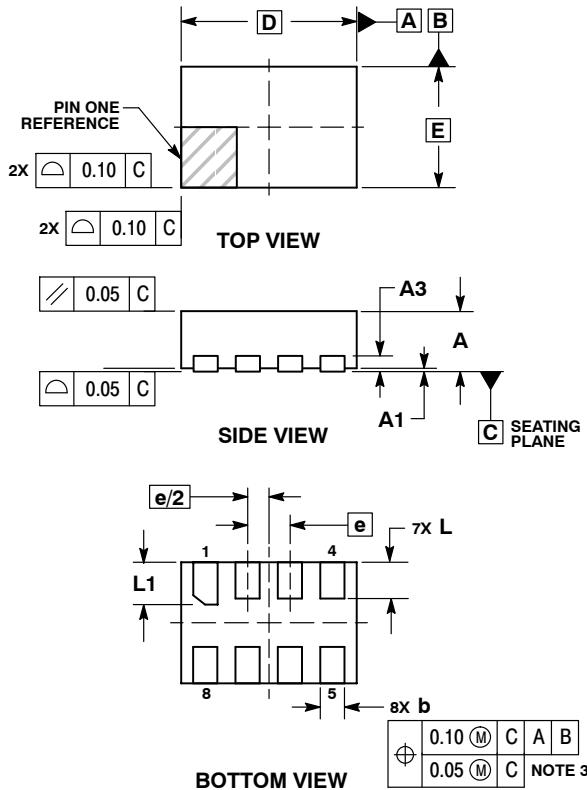
download the ON Semiconductor Soldering and

Mounting Techniques Reference Manual,

SOLDERWIK.

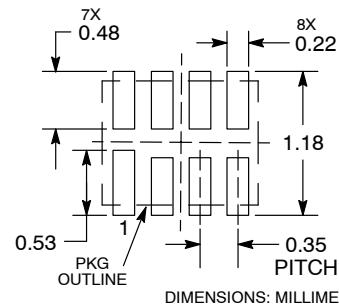
PACKAGE DIMENSIONS

UDFN8, 1.45x1.0, 0.35P
CASE 517BZ
ISSUE O



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

RECOMMENDED
SOLDERING FOOTPRINT*



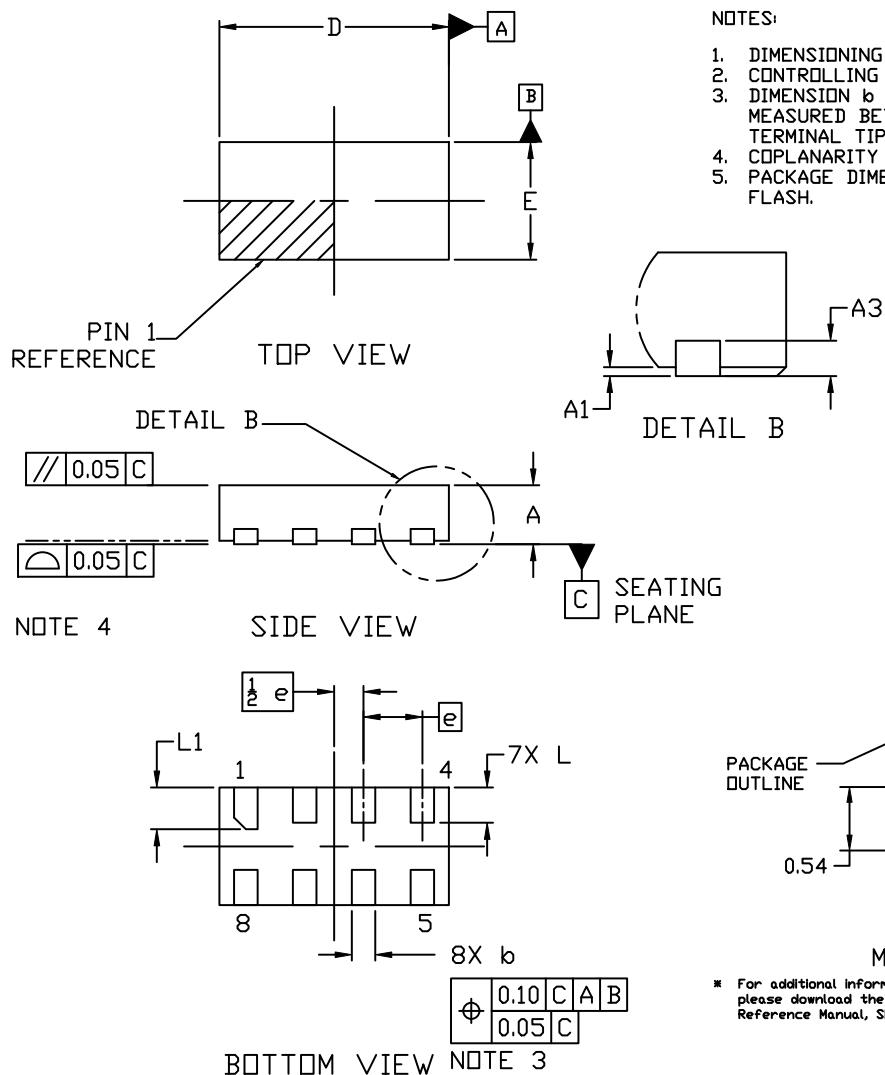
*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PACKAGE DIMENSIONS

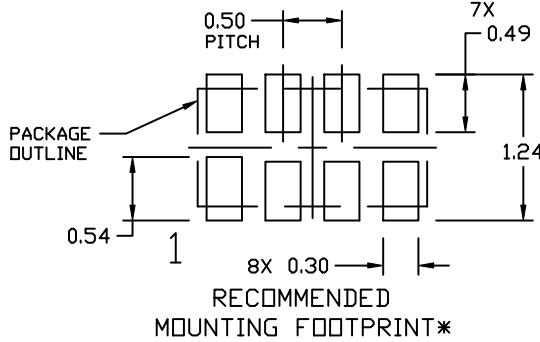
UDFN8, 1.95x1.0, 0.5P

CASE 517CA

ISSUE A



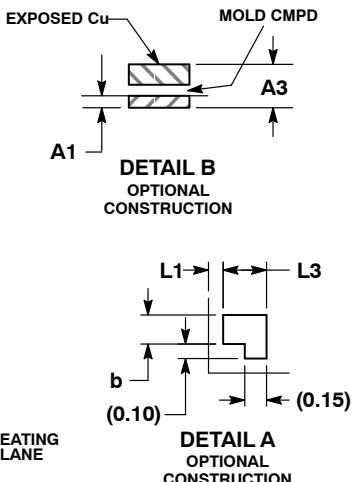
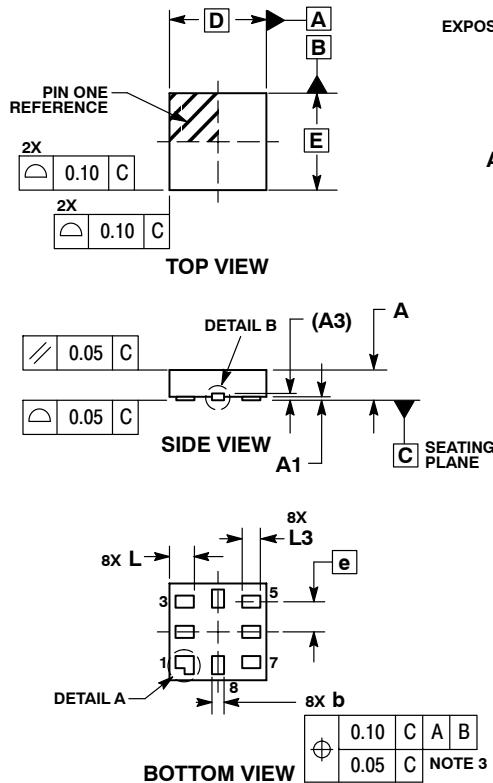
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.45	0.50	0.55
A1	0.00	---	0.05
A3 0.13 REF			
b	0.15	0.20	0.25
D	1.85	1.95	2.05
E	0.90	1.00	1.10
e	0.50 BSC		
L	0.25	0.30	0.35
L1	0.30	0.35	0.40



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

PACKAGE DIMENSIONS

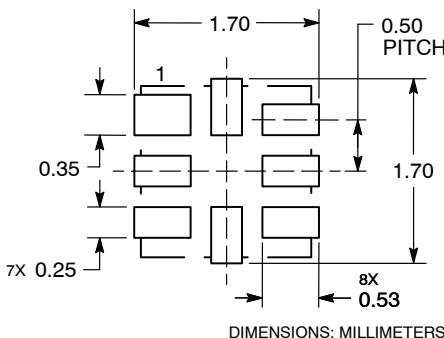
UQFN8, 1.6x1.6, 0.5P
CASE 523AN
ISSUE O



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	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

SOLDERING FOOTPRINT*

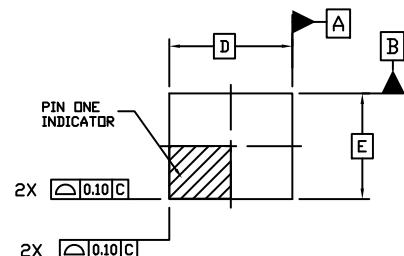
*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PACKAGE DIMENSIONS

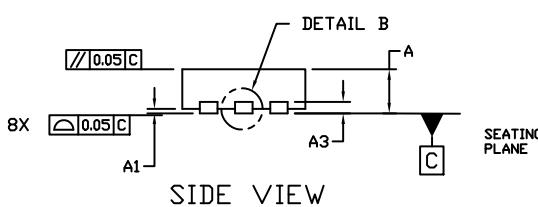
UQFN8, 1.40x1.20, 0.40P

CASE 523AS

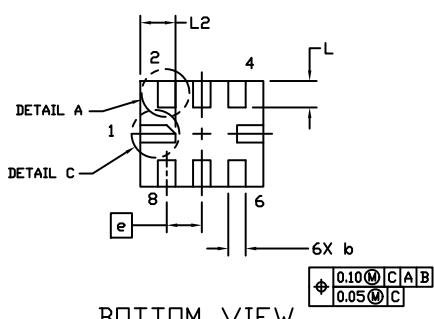
ISSUE B



TOP VIEW



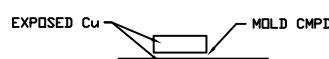
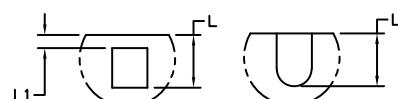
SIDE VIEW



BOTTOM VIEW

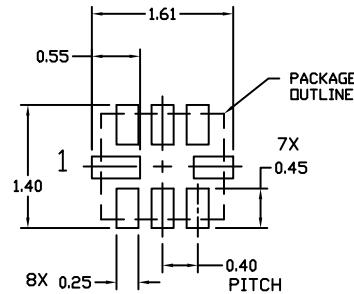
NOTES:

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.

DETAIL B
ALTERNATE CONSTRUCTIONDETAIL A
ALTERNATE CONSTRUCTIONSDETAIL C
ALTERNATE CONSTRUCTION

NOTE 4

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

RECOMMENDED
MOUNTING FOOTPRINT *

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