**ON Semiconductor** 

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# **Dual 2-Input AND Gate**

# NL27WZ08

The NL27WZ08 is a high performance dual 2-input AND Gate operating from a 1.65 V to 5.5 V supply.

# Features

- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation
- 2.5 ns  $t_{PD}$  at  $V_{CC} = 5 V (typ)$
- Inputs/Outputs Overvoltage Tolerant up to 5.5 V
- I<sub>OFF</sub> 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

A1 ——	&	
A2 B2	&	—— Y2

Figure 1. Logic Symbol



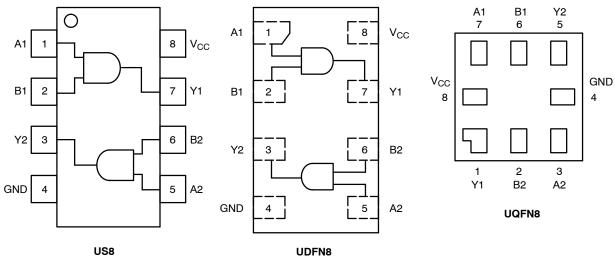
# **ON Semiconductor®**

www.onsemi.com

US8 US SUFFIX CASE 493	MARKING DIAGRAMS
	NLV Prefix
UDFN8, 1.95x1.0 MU1 SUFFIX CASE 517CA	1 • X M
	[]
MU2 SUFFIX CASE 517BY	X M 1 ⁰
UDFN8, 1.45x1.0 MU3 SUFFIX CASE 517BZ	1 <b>o</b>
UQFN8, 1.6x1.6 MQ1 SUFFIX CASE 523AN	1 O XX M•
UQFN8, 1.4x1.2 MQ2 SUFFIX CASE 523AS	1 ×M
	ocation
= Year Code	
- 1001 0000	
= Week Code = Date Code	•
	US SUFFIX CASE 493 UDFN8, 1.95x1.0 MU1 SUFFIX CASE 517CA UDFN8, 1.6x1.0 MU2 SUFFIX CASE 517BY UDFN8, 1.45x1.0 MU3 SUFFIX CASE 517BZ UQFN8, 1.6x1.6 MQ1 SUFFIX CASE 523AN UQFN8, 1.4x1.2 MQ2 SUFFIX CASE 523AS

# **ORDERING INFORMATION**

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



UDFN8

Figure 2. Pinout

### **PIN ASSIGNMENT** (US8 / UDFN8)

Pin	Function
1	A1
2	B1
3	Y2
4	GND
5	A2
6	B2
7	Y1
8	V <sub>CC</sub>

### **PIN ASSIGNMENT** (UQFN8)

· ·	-
Pin	Function
1	Y1
2	B2
3	A2
4	GND
5	Y2
6	B1
7	A1
8	V <sub>CC</sub>

#### FUNCTION TABLE Y = AB

Inp	Output			
Α	A B			
L	L	L		
L	Н	L		
Н	L	L		
Н	Н	Н		

H = HIGH Logic Level L = LOW Logic Level

# MAXIMUM RATINGS

Symbol	Characteris	stics	Value	Unit
$V_{CC}$	DC Supply Voltage	NLV	−0.5 to +7.0 −0.5 to +6.5	V
V <sub>IN</sub>	DC Input Voltage	NLV	−0.5 to +7.0 −0.5 to +6.5	V
V <sub>OUT</sub>	DC Output Voltage (NLV)	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 +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 <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
$I_{CC}$ or $I_{GND}$	DC Supply Current per Supply Pin or Groun	id Pin	±100	mA
T <sub>STG</sub>	Storage Temperature Range		-65 to +150	°C
ΤL	Lead Temperature, 1 mm from Case for 10	secs	260	°C
ТJ	Junction Temperature Under Bias		+150	°C
$\theta_{JA}$	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	-
$V_{ESD}$	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.

 Applicable to devices with outputs that hidy be in-stated.
 Measured with minimum pad spacing on an FR4 board, using 10mm-by-1inch, 2 ounce copper trace no air flow per JESD51-7.
 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 Tri-State Mode ( Power-Down Mode (V <sub>CC</sub>	Note 1) 0	V <sub>CC</sub> 5.5 5.5	
T <sub>A</sub>	Operating Temperature Range	-55	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time $V_{CC} = 1.65 \text{ V to}$ $V_{CC} = 2.3 \text{ V t}$ $V_{CC} = 3.0 \text{ V t}$ $V_{CC} = 4.5 \text{ V t}$	o 2.7 V 0 o 3.6 V 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

			V <sub>CC</sub>	T,	م = 25°0	C	–55°C ≤ T	A ≤ 125°C	
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Max	Units
VIH	High-Level Input		1.65 to 1.95	0.65 V <sub>CC</sub>	-	-	0.65 V <sub>CC</sub>	-	V
	Voltage		2.3 to 5.5	0.70 V <sub>CC</sub>	-	-	0.70 V <sub>CC</sub>	-	
V <sub>IL</sub>	Low-Level Input		1.65 to 1.95	-	-	0.35 V <sub>CC</sub>	-	0.35 V <sub>CC</sub>	V
	Voltage		2.3 to 5.5	-	-	0.30 V <sub>CC</sub>	_	0.30 V <sub>CC</sub>	1
V <sub>OH</sub>	High-Level Output Voltage		1.65 to 5.5 1.65 2.3 2.7 3.0 3.0 4.5	V <sub>CC</sub> - 0.1 1.29 1.9 2.2 2.4 2.3 3.8	V <sub>CC</sub> 1.4 2.1 2.4 2.7 2.5 4.0	- - - - -	V <sub>CC</sub> - 0.1 1.29 1.9 2.2 2.4 2.3 3.8		V
V <sub>OL</sub>	Low-Level Output Voltage		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 <sub>IN</sub>	Input Leakage Current	$V_{IN} = 5.5 \text{ V or GND}$	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	μΑ
I <sub>CC</sub>	Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5	-	-	1.0	-	10	μΑ

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.

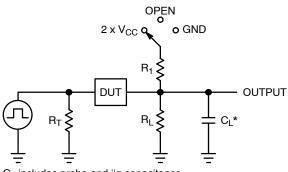
# AC ELECTRICAL CHARACTERISTICS

				٦	a = 25°C	)	T <sub>A</sub> = -55	to 125°C	
Symbol	Parameter	V <sub>CC</sub> (V)	Test Conditions	Min	Тур	Max	Min	Max	Units
t <sub>PLH</sub> ,	Propagation Delay,	1.65 to 1.95	C <sub>L</sub> = 15 pF	-	5.7	10.5	-	11.0	ns
t <sub>PHL</sub>	(A or B) to Y	2.3 to 2.7	R <sub>L</sub> = 1 MΩ R <sub>1</sub> = Open	-	3.5	5.8	-	6.2	
		3.0 to 3.6		-	2.6	3.9	-	4.3	
		4.5 to 5.5		-	1.9	3.1	-	3.3	
		3.0 to 3.6	$C_{L} = 50 \text{ pF},$	-	3.2	4.8	-	5.2	
		4.5 to 5.5	$R_L = 500 \Omega, R_1 = Open$	-	2.5	3.7	_	4.0	

# **CAPACITIVE CHARACTERISTICS**

Symbol	Parameter	Condition	Typical	Units
C <sub>IN</sub>	Input Capacitance	$V_{CC}$ = 5.5 V, $V_{IN}$ = 0 V or $V_{CC}$	2.5	pF
C <sub>OUT</sub>	Output Capacitance	$V_{CC}$ = 5.5 V, $V_{IN}$ = 0 V or $V_{CC}$	2.5	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> = 5.5 V, V <sub>IN</sub> = 0 V or V <sub>CC</sub>	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;  $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$ .

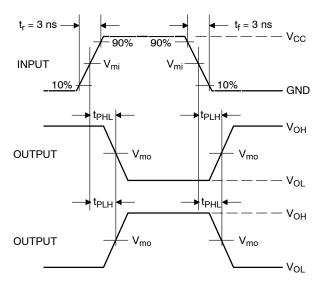


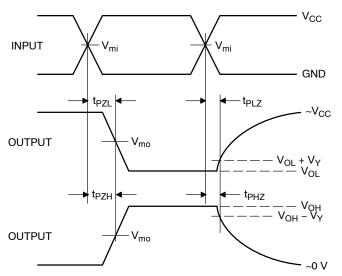
Test	Switch Position	C <sub>L</sub> , pF	$R_{L}, \Omega$	R <sub>1</sub> , Ω
t <sub>PLH</sub> / t <sub>PHL</sub>	Open	See AC Character	istics Tal	ole
t <sub>PLZ</sub> / t <sub>PZL</sub>	$2 \times V_{CC}$	50	500	500
$t_{PHZ}$ / $t_{PZH}$	GND	50	500	500
X = Don't Car	е			

 $\mathbf{R}_{\mathbf{L}}, \Omega \quad \mathbf{R}_{\mathbf{1}}, \Omega$ 

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

# Figure 3. Test Circuit





# Figure 4. Switching Waveforms

		Vm		
V <sub>CC</sub> , V	V <sub>mi</sub> , V	t <sub>PLH</sub> , t <sub>PHL</sub>	t <sub>PZL</sub> , t <sub>PLZ</sub> , t <sub>PZH</sub> , t <sub>PHZ</sub>	V <sub>Y</sub> , V
1.65 to 1.95	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	0.15
2.3 to 2.7	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	0.15
3.0 to 3.6	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	0.3
4.5 to 5.5	V <sub>CC</sub> /2	V <sub>CC</sub> /2	V <sub>CC</sub> /2	0.3

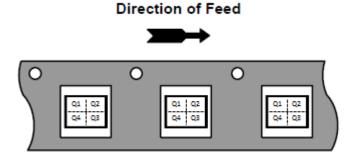
## **DEVICE ORDERING INFORMATION**

Device	Packages	Specific Device Code	Pin 1 Orientation (See below)	Shipping <sup>†</sup>
NL27WZ08USG	US8	L2	Q4	3000 / Tape & Reel
NLV27WZ08USG*	US8	L2	Q4	3000 / Tape & Reel
NL27WZ08MQ1TCG	UQFN8, 1.6 x 1.6, 0.5P	AD	Q1	3000 / Tape & Reel
NL27WZ08MU1TCG	UDFN8, 1.95 x 1.0, 0.5P	AH	Q4	3000 / Tape & Reel
NL27WZ08MU1TWG	UDFN8, 1.95 x 1.0, 0.5P	AK	Q1	3000 / Tape & Reel
NL27WZ08MU3TCG	UDFN8, 1.45 x 1.0, 0.35P	F	Q4	3000 / Tape & Reel
NL27WZ08MU2TCG	UDFN8, 1.6 x 1.0, 0.4P	AJ	Q4	3000 / Tape & Reel
NL27WZ08MQ2TCG (In Development)	UQFN8, 1.4 x 1.2, 0.4P	TBD	TBD	3000 / Tape & Reel

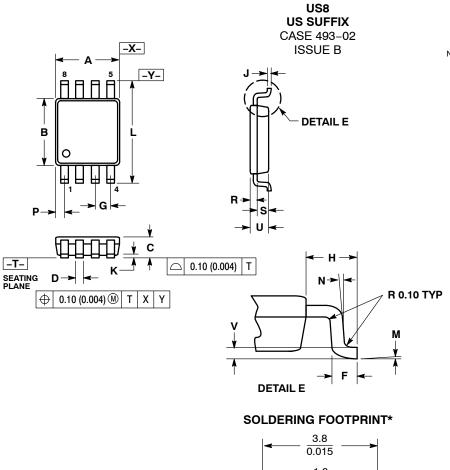
+For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D. \*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC–Q100 Qualified and PPAP

Capable.

# Pin 1 Orientation in Tape and Reel

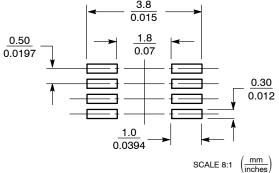


# PACKAGE DIMENSIONS



- NOTES:
   DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
   CONTROLLING DIMENSION: MILLIMETERS.
   DIMENSION "A" DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR. MOLD FLASH. PROTRUSION AND GATE BURR SHALL NOT EXCEED 0.140 MM (0.0055") PER SIDE.
   DIMENSION "B" DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSION. INTER-LEAD FLASH AND PROTRUSION SHALL NOT E3XCEED 0.140 (0.0055") PER
- SHALL NOT E3XCEED 0.140 (0.0055") PER
- SIDE.
  SIDE.
  LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076-0.0203 MM.
- (300–800 "). 6. ALL TOLERANCE UNLESS OTHERWISE SPECIFIED ±0.0508 (0.0002 ").

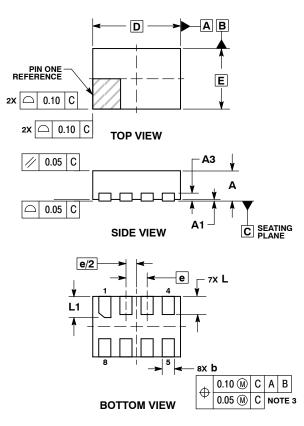
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
Α	1.90	2.10	0.075	0.083
В	2.20	2.40	0.087	0.094
С	0.60	0.90	0.024	0.035
D	0.17	0.25	0.007	0.010
F	0.20	0.35	0.008	0.014
G	0.50 BSC		0.020 BSC	
н	0.40 REF		0.016 REF	
J	0.10	0.18	0.004	0.007
к	0.00	0.10	0.000	0.004
L	3.00	3.20	0.118	0.126
м	0 °	6 °	0 °	6 °
Ν	5 °	10 °	5 °	10 °
Р	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	



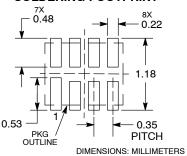
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# PACKAGE DIMENSIONS

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



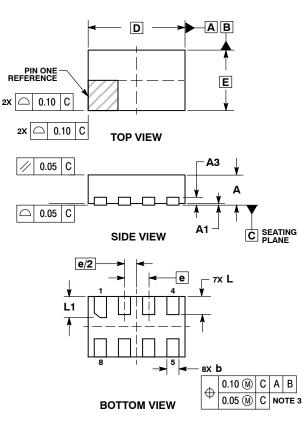
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 CONTROLLING DIMENSION: MILLIMETERS.
 DIMENSION & APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP. PACKAGE DIMENSIONS EXCLUSIVE OF 4 BURRS AND MOLD FLASH. MILLIMETERS DIM MIN MAX A A1 0.45 0.55 0.00 0.05 0.13 REF A3 b 0.15 0.25 D 1.45 BSC 1.00 BSC 0.35 BSC е L L1 0.25 0.35 0.30 0.40 RECOMMENDED SOLDERING 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

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

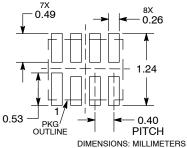


NOTES:

- NOTES: 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994. 2. CONTROLLING DIMENSION: MILLIMETERS. 3. DIMENSION & 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.

BURRS AND MOLD FL					
MILLIMETERS					
MIN	MAX				
0.45	0.55				
0.00	0.05				
0.13 REF					
0.15	0.25				
1.60 BSC					
1.00 BSC					
0.40 BSC					
0.25	0.35				
0.30	0.40				
	MILLIN MIN 0.45 0.00 0.13 0.15 1.60 1.00 0.40 0.25				

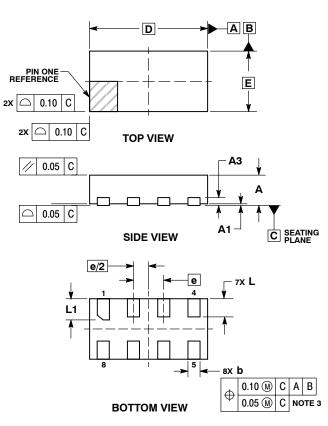
RECOMMENDED **SOLDERING FOOTPRINT\*** 



\*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

UDFN8, 1.95x1, 0.5P CASE 517CA ISSUE O

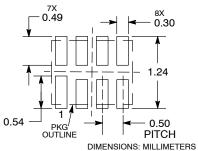


NOTES:

- NOTES:
   DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
   CONTROLLING DIMENSION: MILLIMETERS.
   DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP.
   PACKAGE DIMENSIONS EXCLUSIVE OF BUIDES AND MOL D ELASH ASH.

BURRS AND MOLD FL				
	MILLIMETERS			
DIM	MIN	MAX		
Α	0.45	0.55		
A1	0.00	0.05		
A3	0.13 REF			
b	0.15	0.25		
D	1.95 BSC			
Е	1.00 BSC			
е	0.50 BSC			
L	0.25	0.35		
L1	0.30	0.40		
	DIM A A1 A3 b D E e	MILLIN           DIM         MIN           A         0.45           A1         0.00           A3         0.13           b         0.15           D         1.95           E         1.00           e         0.50           L         0.25	MILLIMETERS           MIN         MAX           A         0.45         0.55           A1         0.00         0.05           A3         0.13         REF           b         0.15         0.25           D         1.95         BSC           E         1.00         BSC           e         0.50         BSC           L         0.25         0.35	

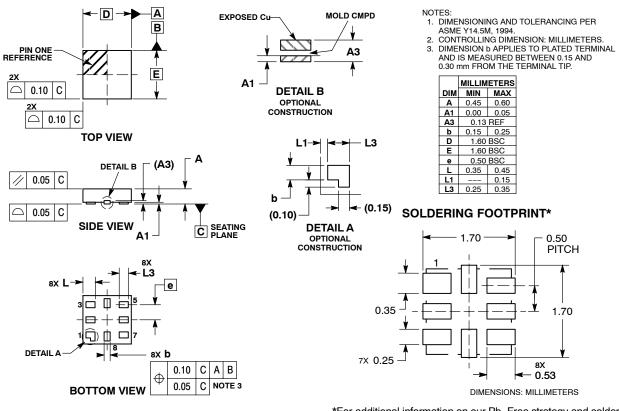
#### RECOMMENDED **SOLDERING FOOTPRINT\***



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# PACKAGE DIMENSIONS

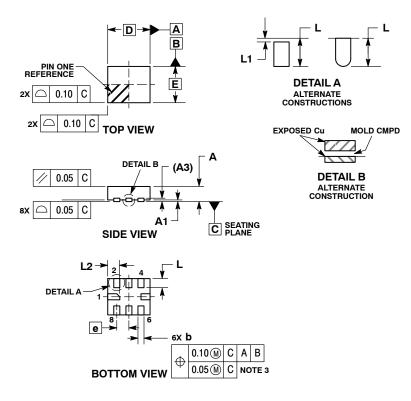
UQFN8, 1.6x1.6, 0.5P CASE 523AN ISSUE O



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#### PACKAGE DIMENSIONS

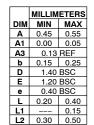
UQFN8, 1.4x1.2, 0.4P CASE 523AS **ISSUE A** 



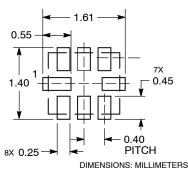
NOTES:

1. DIMENSIONING AND TOLERANCING PER

ASME Y14.5M, 1994. CONTROLLING DIMENSION: MILLIMETERS. DIMENSION & APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.25 mm FROM THE TERMINAL TIP.



#### SOLDERING 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.

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