NLU1GT125

Non-Inverting 3-State Buffer, TTL Level

LSTTL−Compatible Inputs

The NLU1GT125 MiniGate™ is an advanced CMOS high−speed non−inverting buffer in ultra−small footprint.

The NLU1GT125 requires the 3−state control input $\overline{OE}$ to be set High to place the output in the high impedance state.

The device input is compatible with TTL−type input thresholds and the output has a full 5.0 V CMOS level output swing.

The NLU1GT125 input and output structures provide protection when voltages up to 7.0 V are applied, regardless of the supply voltage.

Features

- High Speed: t_{PD} = 3.8 ns (Typ) @ V_{CC} = 5.0 V
- Low Power Dissipation: I_{CC} = 1 μA (Max) at T_A = 25°C
- TTL−Compatible Input: V_{IL} = 0.8 V; V_{IH} = 2.0 V
- CMOS−Compatible Output:
  $V_{OH} > 0.8\ V_{CC}$; $V_{OL} < 0.1\ V_{CC}$ @ Load
- Power Down Protection Provided on inputs
- Balanced Propagation Delays
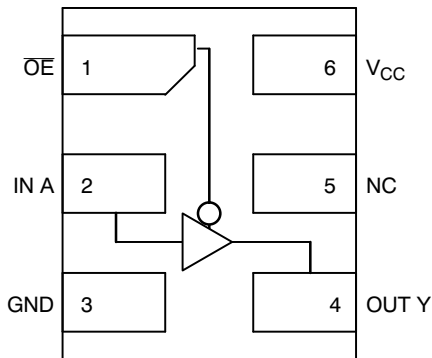- Ultra−Small Packages
- These are Pb−Free Devices
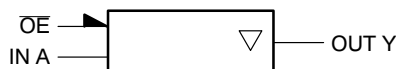
Figure 1. Pinout (Top View)

Figure 2. Logic Symbol

FUNCTION TABLE

Input		Output
A	**$\overline{OE}$**	**Y**
L	L	L
H	L	H
X	H	Z

ON Semiconductor®

http://onsemi.com

MARKING DIAGRAMS

UDFN6
1.2 x 1.0
CASE 517AA

7M

ULLGA6
1.0 x 1.0
CASE 613AD

7M

ULLGA6
1.2 x 1.0
CASE 613AE

7M

ULLGA6
1.45 x 1.0
CASE 613AF

7M

UDFN6
1.0 x 1.0
CASE 517BX

L M

UDFN6
1.45 x 1.0
CASE 517AQ

D M

7 = Device Marking
M = Date Code

PIN ASSIGNMENT

1	$\overline{OE}$
2	IN A
3	GND
4	OUT Y
5	NC
6	V_{CC}

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{CC}	DC Supply Voltage		−0.5 to +7.0	V
V_{IN}	DC Input Voltage		−0.5 to +7.0	V
V_{OUT}	DC Output Voltage		−0.5 to +7.0	V
I_{IK}	DC Input Diode Current	V_{IN} < GND	−20	mA
I_{OK}	DC Output Diode Current	V_{OUT} < GND	±20	mA
I_O	DC Output Source/Sink Current		±12.5	mA
I_{CC}	DC Supply Current Per Supply Pin		±25	mA
I_{GND}	DC Ground Current per Ground Pin		±25	mA
T_{STG}	Storage Temperature Range		−65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds		260	°C
T_J	Junction Temperature Under Bias		150	°C
MSL	Moisture Sensitivity		Level 1	
F_R	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V−0 @ 0.125 in	
$I_{LATCHUP}$	Latchup Performance Above V_{CC} and Below GND at 125°C (Note 2)		±500	mA

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.
1. Measured with minimum pad spacing on an FR4 board, using 10 mm−by−1 inch, 2 ounce copper trace no air flow.
2. Tested to EIA / JESD78.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	Positive DC Supply Voltage		1.65	5.5	V
V_{IN}	Digital Input Voltage		0	5.5	V
V_{OUT}	Output Voltage		0	5.5	V
T_A	Operating Free−Air Temperature		−55	+125	°C
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate	V_{CC} = 3.3 V ± 0.3 V V_{CC} = 5.0 V ± 0.5 V	0 0	100 20	ns/V

NLU1GT125

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V$_{CC}$ (V)	T$_A$ = 25 °C Min	Typ	Max	T$_A$ = +85°C Min	Max	T$_A$ = −55°C to +125°C Min	Max	Unit
V$_{IH}$	Low−Level Input Voltage		3.0 4.5 to 5.5	1.4 2.0			1.4 2.0		1.4 2.0		V
V$_{IL}$	Low−Level Input Voltage		3.0 4.5 to 5.5			0.53 0.8		0.53 0.8		0.53 0.8	V
V$_{OH}$	High−Level Output Voltage	V$_{IN}$ = V$_{IH}$ or V$_{IL}$ I$_{OH}$ = −50 μA	3.0 4.5	2.9 4.4	3.0 4.5		2.9 4.4		2.9 4.4		V
		V$_{IN}$ = V$_{IH}$ or V$_{IL}$ I$_{OH}$ = −4 mA I$_{OH}$ = −8 mA	3.0 4.5	2.58 3.94			2.48 3.80		2.34 3.66		
V$_{OL}$	Low−Level Output Voltage	V$_{IN}$ = V$_{IH}$ or V$_{IL}$ I$_{OL}$ = 50 μA	3.0 4.5		0 0	0.1 0.1		0.1 0.1		0.1 0.1	V
		V$_{IN}$ = V$_{IH}$ or V$_{IL}$ I$_{OL}$ = 4 mA I$_{OL}$ = 8 mA	3.0 4.5			0.36 0.36		0.44 0.44		0.52 0.52	
I$_{IN}$	Input Leakage Current	0 ≤ V$_{IN}$ ≤ 5.5 V	0 to 5.5			±0.1		±1.0		±1.0	μA
I$_{CC}$	Quiescent Supply Current	0 ≤ V$_{IN}$ ≤ V$_{CC}$	5.5			1.0		20		40	μA
I$_{CCT}$	Quiescent Supply Current	V$_{IN}$ = 3.4 V Other Input: V$_{CC}$ or GND	5.5			1.35		1.50		1.65	mA
I$_{OPD}$	Output Leakage Current	V$_{OUT}$ = 5.5 V	0.0			0.5		5.0		10	μA
I$_{OZ}$	3−State Leakage Current	V$_{IN}$ = V$_{IH}$ or V$_{IL}$ V$_{OUT}$ = V$_{CC}$ or GND	0.0			±0.25		±2.5		±2.5	μA

AC ELECTRICAL CHARACTERISTICS (Input t$_r$ = t$_f$ = 3.0 ns)

Symbol	Parameter	V$_{CC}$ (V)	Test Condition	T$_A$ = 25 °C Min	Typ	Max	T$_A$ = +85°C Min	Max	T$_A$ = −55°C to +125°C Min	Max	Unit
t$_{PLH}$, t$_{PHL}$	Propagation Delay, A to **Y** (Figures 3 and 5)	3.0 to 3.6	C$_L$ = 15 pF C$_L$ = 50 pF		5.6 8.1	8.0 11.5	1.0 1.0	9.5 13.0		12.0 16.0	ns
		4.5 to 5.5	C$_L$ = 15 pF C$_L$ = 50 pF		3.8 5.3	5.5 7.5	1.0 1.0	6.5 8.5		8.5 10.5	
t$_{PZL}$, t$_{PZH}$	Output Enable Time, $\overline{OE}$ to Y (Figures 4 and 6)	3.0 to 3.6	C$_L$ = 15 pF C$_L$ = 50 pF		5.4 7.9	8.0 11.5	1.0 1.0	9.5 13.0		11.5 15.0	ns
		4.5 to 5.5	C$_L$ = 15 pF C$_L$ = 50 pF		3.6 5.1	5.1 7.1	1.0 1.0	6.0 8.0		7.5 9.5	
t$_{PLZ}$, t$_{PHZ}$	Output Disable Time, $\overline{OE}$ to Y (Figures 4 and 6)	3.0 to 3.6	C$_L$ = 15 pF C$_L$ = 50 pF		6.5 8.0	9.7 13.2	1.0 1.0	11.5 15.0		14.5 18.5	ns
		4.5 to 5.5	C$_L$ = 15 pF C$_L$ = 50 pF		4.8 7.0	6.8 8.8	1.0 1.0	8.0 10.0		10.0 12.0	
C$_{IN}$	Input Capacitance				4	10		10		10.0	pF
C$_{OUT}$	3−State Output Capacitance (Output in High Impedance State)				6						pF
C$_{PD}$	Power Dissipation Capacitance (Note 3)	5.0			14						pF

3. C$_{PD}$ is defined as the value of the internal equivalent capacitance which is calculated from the dynamic 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$_{CC}$.
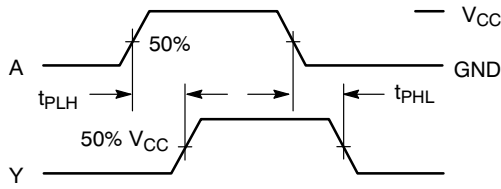
NLU1GT125
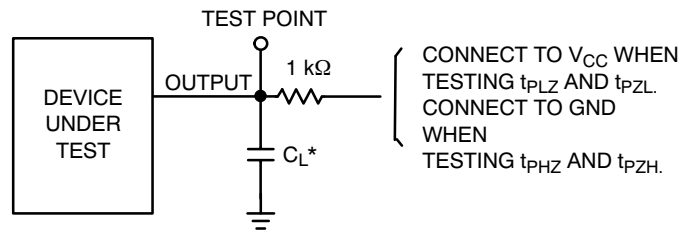
SWITCHING WAVEFORMS

Figure 3. Switching Waveforms
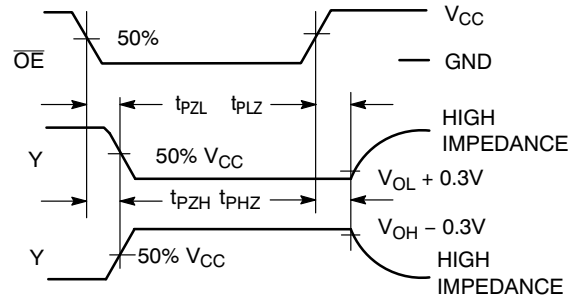
Figure 4.
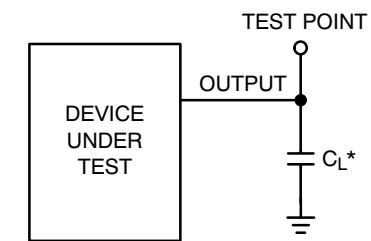
*Includes all probe and jig capacitance

Figure 5. Test Circuit

*Includes all probe and jig capacitance

Figure 6. Test Circuit
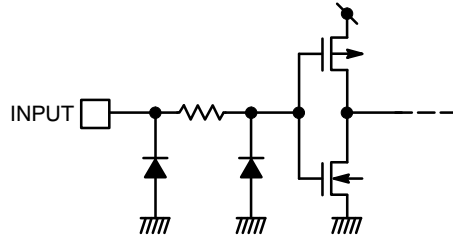
Figure 7. Input Equivalent Circuit
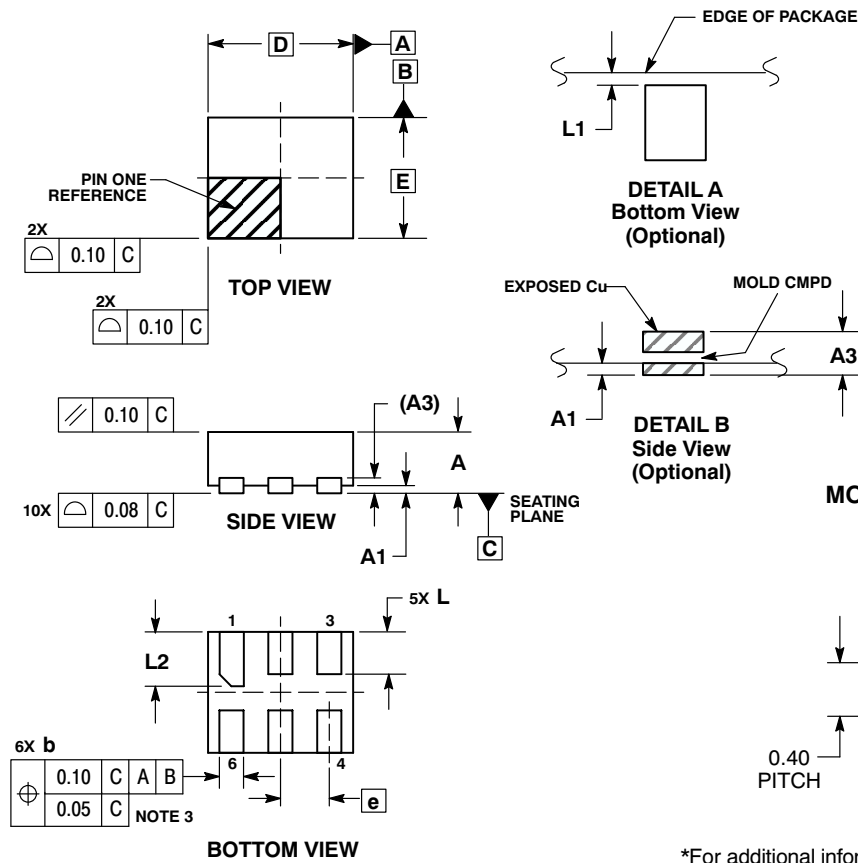
ORDERING INFORMATION

Device	Package	Shipping†
NLU1GT125MUTCG	UDFN6, 1.2 x 1.0, 0.4P (Pb−Free)	3000 / Tape & Reel
NLU1GT125AMX1TCG	ULLGA6, 1.45 x 1.0, 0.5P (Pb−Free)	3000 / Tape & Reel
NLU1GT125BMX1TCG	ULLGA6, 1.2 x 1.0, 0.4P (Pb−Free)	3000 / Tape & Reel
NLU1GT125CMX1TCG	ULLGA6, 1.0 x 1.0, 0.35P (Pb−Free)	3000 / Tape & Reel
NLU1GT125AMUTCG	UDFN6, 1.45 x 1.0, 0.5P (Pb−Free)	3000 / Tape & Reel
NLU1GT125CMUTCG	UDFN6, 1.0 x 1.0, 0.35P (Pb−Free)	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.

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PACKAGE DIMENSIONS

UDFN6, 1.2x1.0, 0.4P
CASE 517AA
ISSUE C

TOP VIEW

D

A
B

E

PIN ONE
REFERENCE

2X
⌀ 0.10 C

2X
⌀ 0.10 C

SIDE VIEW

∥ 0.10 C

(A3)

A

10X ⌀ 0.08 C

SEATING
PLANE

A1

C

BOTTOM VIEW

5X L

1   3

L2

6   4

6X b
⊕ 0.10 C A B
0.05 C NOTE 3

e

EDGE OF PACKAGE

L1

DETAIL A
Bottom View
(Optional)

EXPOSED Cu   MOLD CMPD

A3

A1

DETAIL B
Side View
(Optional)

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 0.25 AND
   0.30 mm FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED
   PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.127 REF	
b	0.15	0.25
D	1.20 BSC	
E	1.00 BSC	
e	0.40 BSC	
L	0.30	0.40
L1	0.00	0.15
L2	0.40	0.50

MOUNTING FOOTPRINT*
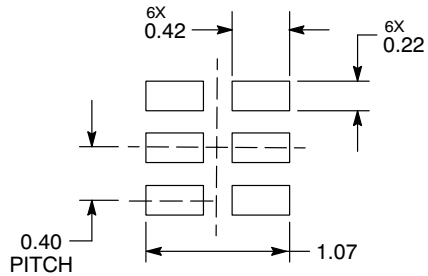
6X
0.42
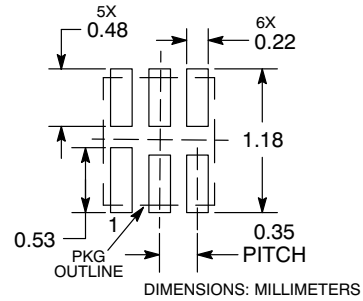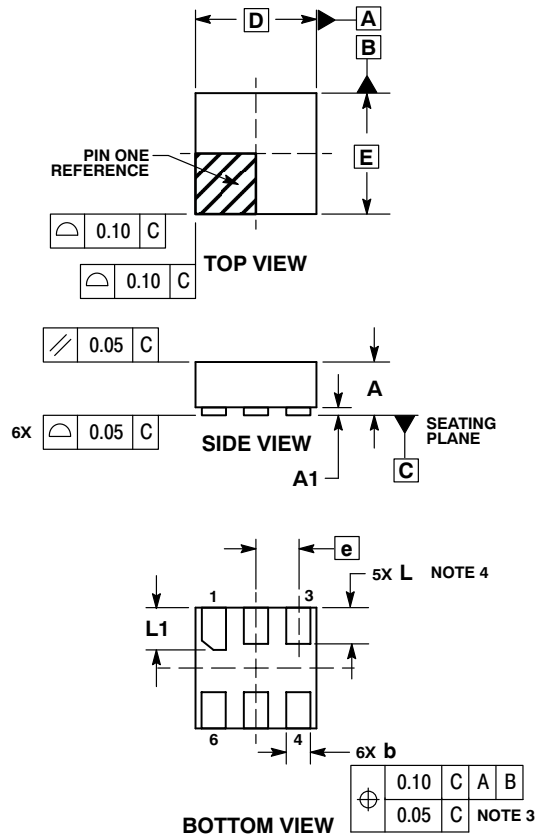
6X
0.22

0.40
PITCH

1.07

DIMENSIONS: MILLIMETERS

*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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PACKAGE DIMENSIONS

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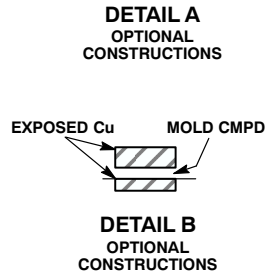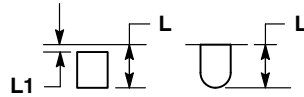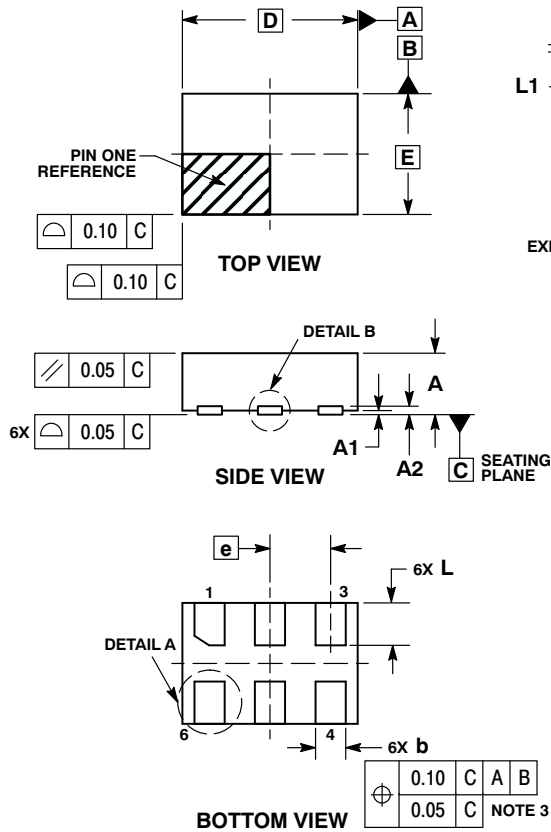
TOP VIEW

PIN ONE
REFERENCE

| ⌒ | 0.10 | C |

| ⌒ | 0.10 | C |

SIDE VIEW

| ∕∕ | 0.05 | C |

6X | ⌒ | 0.05 | C |

DETAIL B

A
A1
A2

| C | SEATING PLANE |

BOTTOM VIEW

e
6X **L**
1   3
DETAIL A
6   4
6X **b**

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

L   **L**

L1

DETAIL A
OPTIONAL
CONSTRUCTIONS

EXPOSED Cu   MOLD CMPD
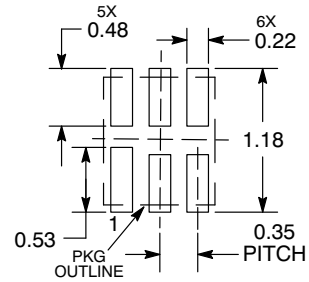
DETAIL B
OPTIONAL
CONSTRUCTIONS

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.

	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
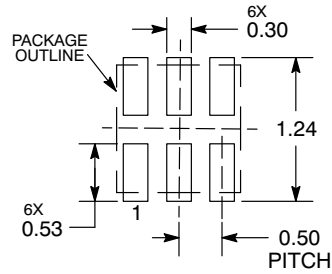
PACKAGE
OUTLINE

6X
0.30

1.24

6X
0.53

1

0.50
PITCH

DIMENSIONS: MILLIMETERS

*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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PACKAGE DIMENSIONS

UDFN6 1.0x1.0, 0.35P
CASE 517BX
ISSUE O
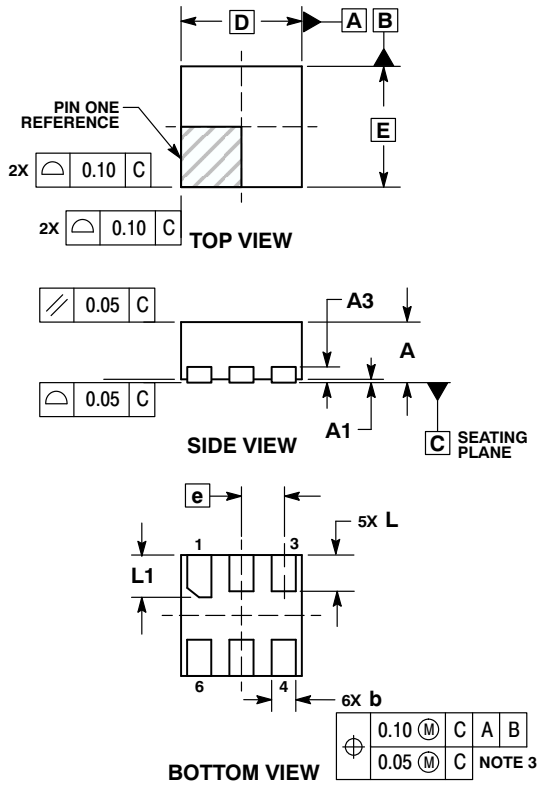
TOP VIEW
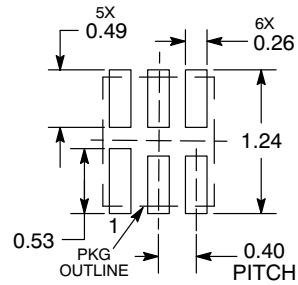
SIDE VIEW

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 0.20 MM FROM TERMINAL TIP.
4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

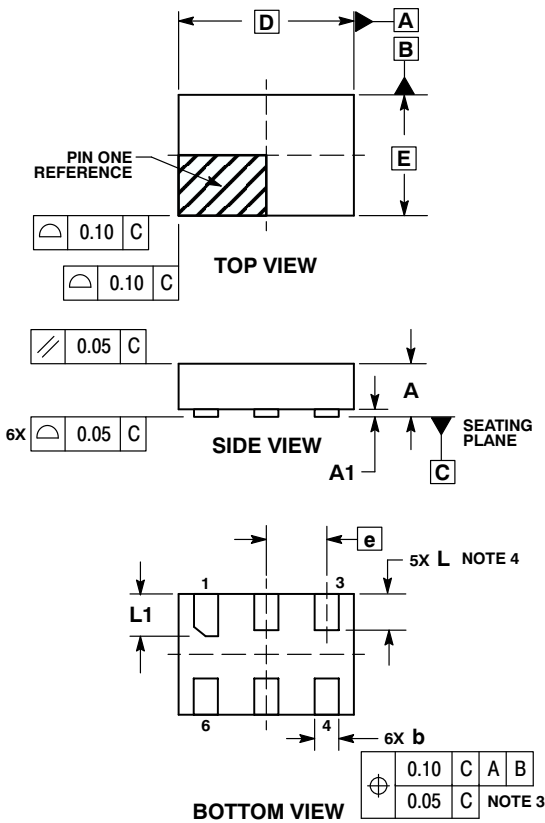| DIM	MILLIMETERS	
	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13 REF	
b	0.12	0.22
D	1.00 BSC	
E	1.00 BSC	
e	0.35 BSC	
L	0.25	0.35
L1	0.30	0.40

RECOMMENDED SOLDERING FOOTPRINT*

DIMENSIONS: MILLIMETERS

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NLU1GT125

PACKAGE DIMENSIONS

ULLGA6 1.0x1.0, 0.35P
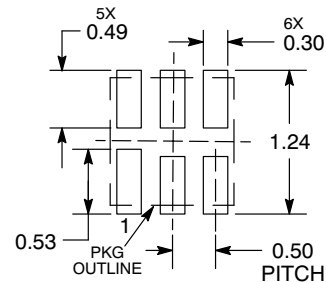CASE 613AD
ISSUE A

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 0.30 mm FROM THE TERMINAL TIP.
4. A MAXIMUM OF 0.05 PULL BACK OF THE PLATED TERMINAL FROM THE EDGE OF THE PACKAGE IS ALLOWED.

DIM	MILLIMETERS	
	MIN	MAX
A	---	0.40
A1	0.00	0.05
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

MOUNTING FOOTPRINT
SOLDERMASK DEFINED*

DIMENSIONS: MILLIMETERS

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PACKAGE DIMENSIONS

ULLGA6 1.2x1.0, 0.4P
CASE 613AE
ISSUE A
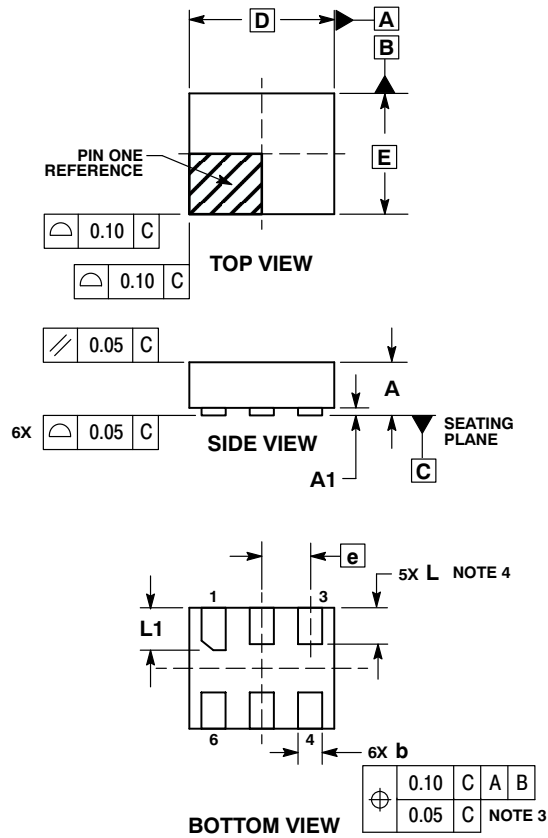
TOP VIEW

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 0.30 mm FROM THE TERMINAL TIP.
4. A MAXIMUM OF 0.05 PULL BACK OF THE PLATED TERMINAL FROM THE EDGE OF THE PACKAGE IS ALLOWED.

| DIM | MILLIMETERS | |
	MIN	MAX
A	–––	0.40
A1	0.00	0.05
b	0.15	0.25
D	1.20 BSC	
E	1.00 BSC	
e	0.40 BSC	
L	0.25	0.35
L1	0.35	0.45

MOUNTING FOOTPRINT
SOLDERMASK DEFINED*

DIMENSIONS: MILLIMETERS

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PACKAGE DIMENSIONS

ULLGA6 1.45x1.0, 0.5P
CASE 613AF
ISSUE A

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.
4. A MAXIMUM OF 0.05 PULL BACK OF THE PLATED TERMINAL FROM THE EDGE OF THE PACKAGE IS ALLOWED.

| DIM | MILLIMETERS | |
	MIN	MAX
A	–––	0.40
A1	0.00	0.05
b	0.15	0.25
D	1.45 BSC	
E	1.00 BSC	
e	0.50 BSC	
L	0.25	0.35
L1	0.30	0.40

TOP VIEW

SIDE VIEW

BOTTOM VIEW

MOUNTING FOOTPRINT
SOLDERMASK DEFINED*

DIMENSIONS: MILLIMETERS

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