

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: $t_{PD} = 3.8 \text{ ns}$ (Typ) @ $V_{CC} = 5.0 \text{ V}$
- Low Power Dissipation: $I_{CC} = 1 \mu\text{A}$ (Max) at $T_A = 25^\circ\text{C}$
- TTL-Compatible Input: $V_{IL} = 0.8 \text{ V}$; $V_{IH} = 2.0 \text{ V}$
- 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
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These are Pb-Free Devices

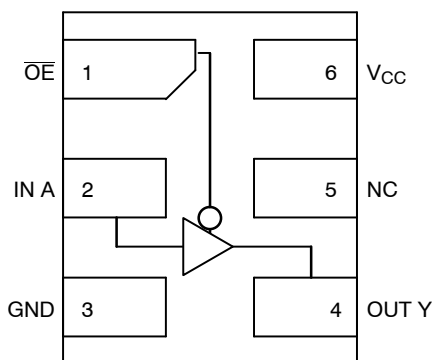


Figure 1. Pinout (Top View)



Figure 2. Logic Symbol

FUNCTION TABLE

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

PIN ASSIGNMENT

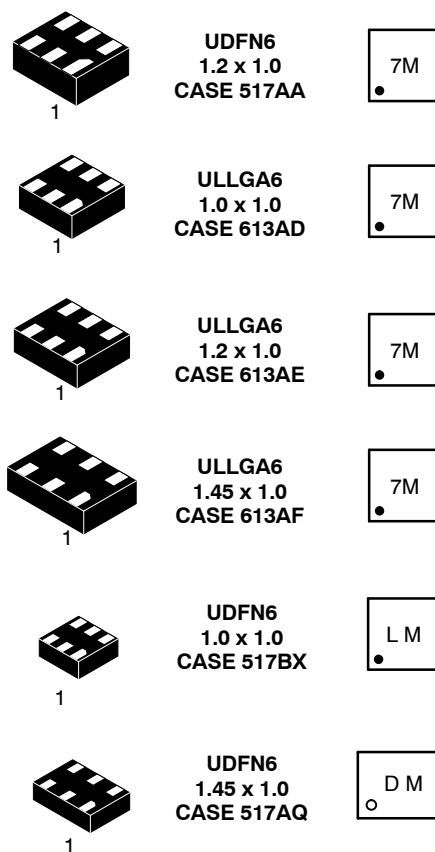
1	\overline{OE}
2	IN A
3	GND
4	OUT Y
5	NC
6	V_{CC}



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MARKING DIAGRAMS



7 = Device Marking
M = Date Code

ORDERING INFORMATION

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

NLU1GT125

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 $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	0 0	100 20	ns/V

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = 25 °C			T _A = +85°C		T _A = -55°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
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 _{CC} T	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			T _A = +85°C		T _A = -55°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
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, $\overline{\text{OE}}$ 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, $\overline{\text{OE}}$ 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}.

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SWITCHING WAVEFORMS

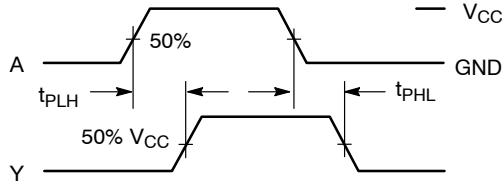


Figure 3. Switching Waveforms

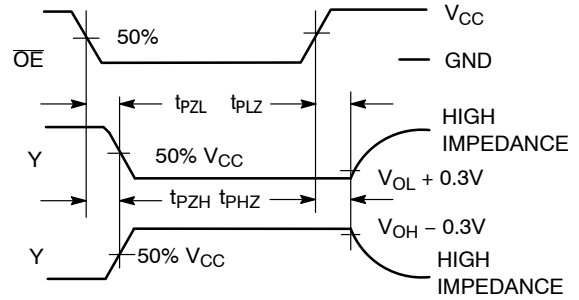


Figure 4.

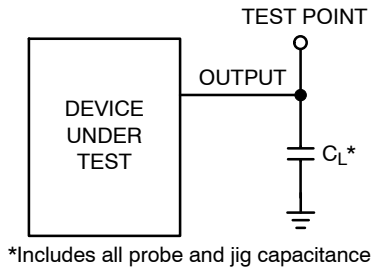


Figure 5. Test Circuit

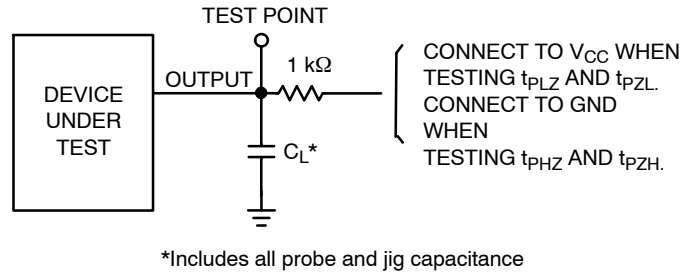


Figure 6. Test Circuit

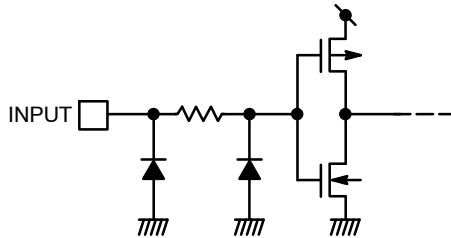


Figure 7. Input Equivalent Circuit

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, NLVU1GT125AMUTCG*	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

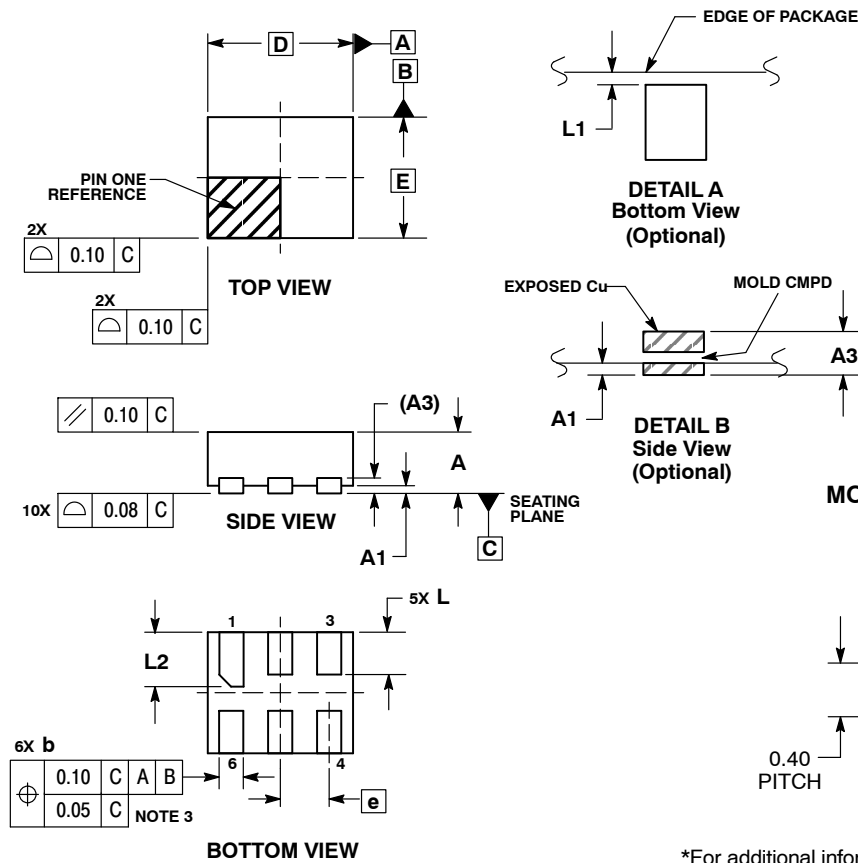
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

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PACKAGE DIMENSIONS

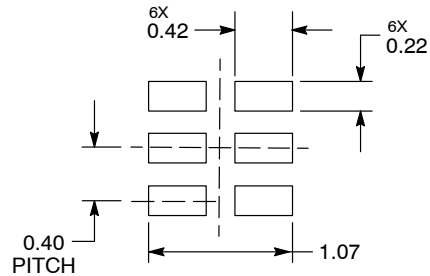
UDFN6, 1.2x1.0, 0.4P
CASE 517AA
ISSUE C



- 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.

MILLIMETERS		
DIM	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*



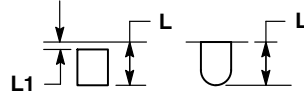
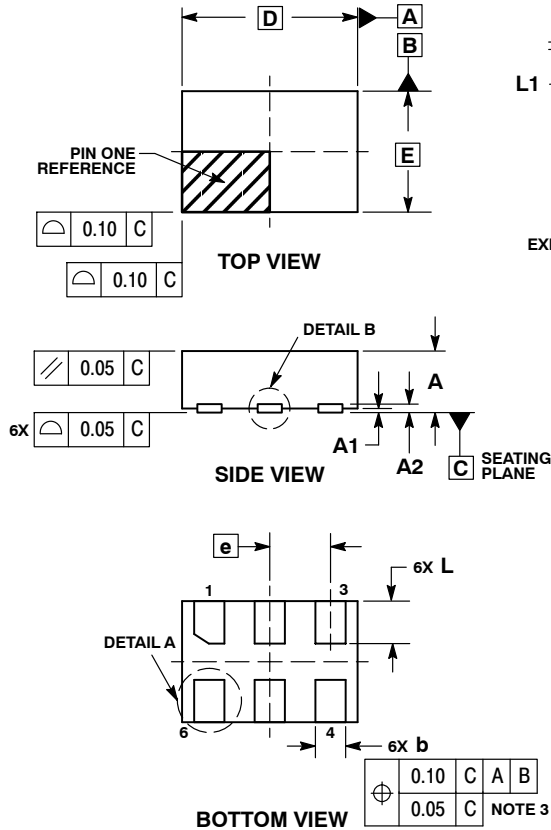
DIMENSIONS: MILLIMETERS

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

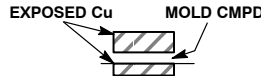
NLU1GT125

PACKAGE DIMENSIONS

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



DETAIL A
OPTIONAL
CONSTRUCTIONS



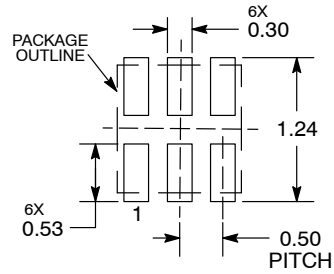
DETAIL B
OPTIONAL
CONSTRUCTIONS

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



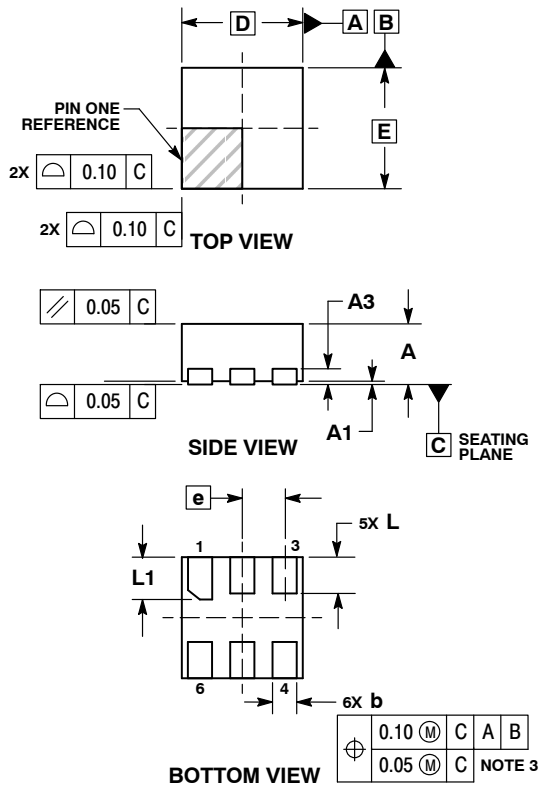
DIMENSIONS: MILLIMETERS

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NLU1GT125

PACKAGE DIMENSIONS

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

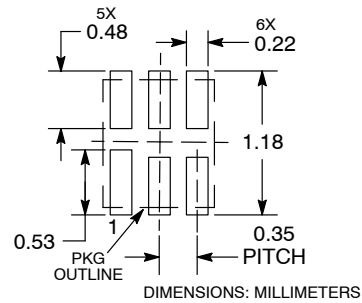


NOTES:

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	0.12	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*

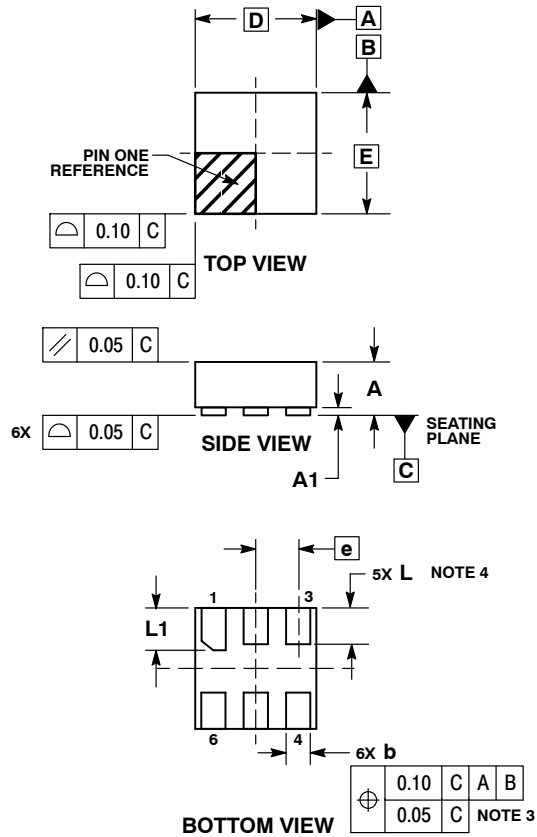


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NLU1GT125

PACKAGE DIMENSIONS

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

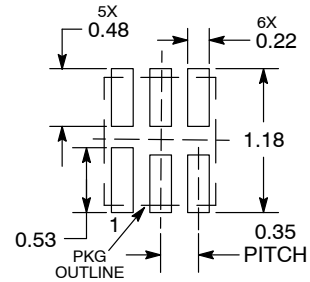


NOTES:

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.

MILLIMETERS		
DIM	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*



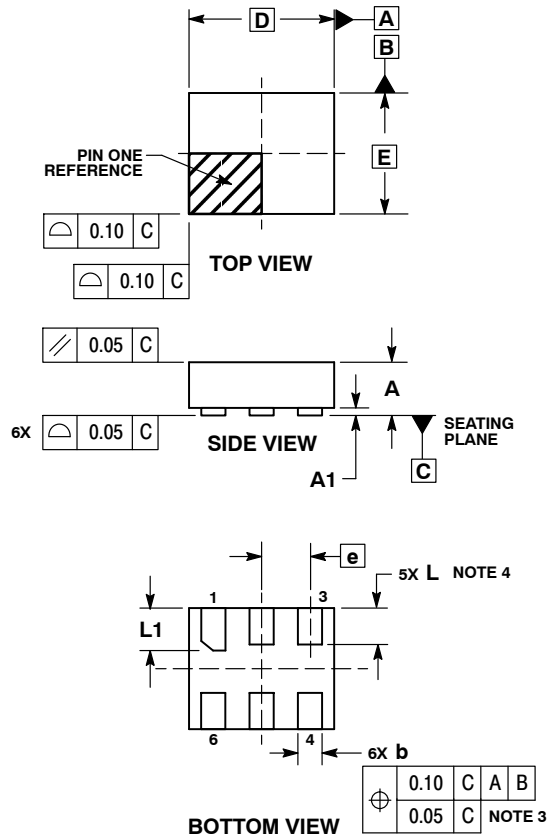
DIMENSIONS: MILLIMETERS

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

NLU1GT125

PACKAGE DIMENSIONS

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

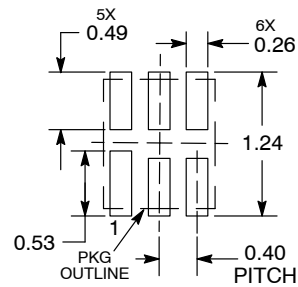


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MILLIMETERS		
DIM	MIN	MAX
A	---	0.40
A1	0.00	0.05
b	0.15	0.25
D	1.20 BSC	
E	1.00 BSC	
e	0.40 BSC	
L	0.25	0.35
L1	0.35	0.45

MOUNTING FOOTPRINT SOLDEMASK DEFINED*



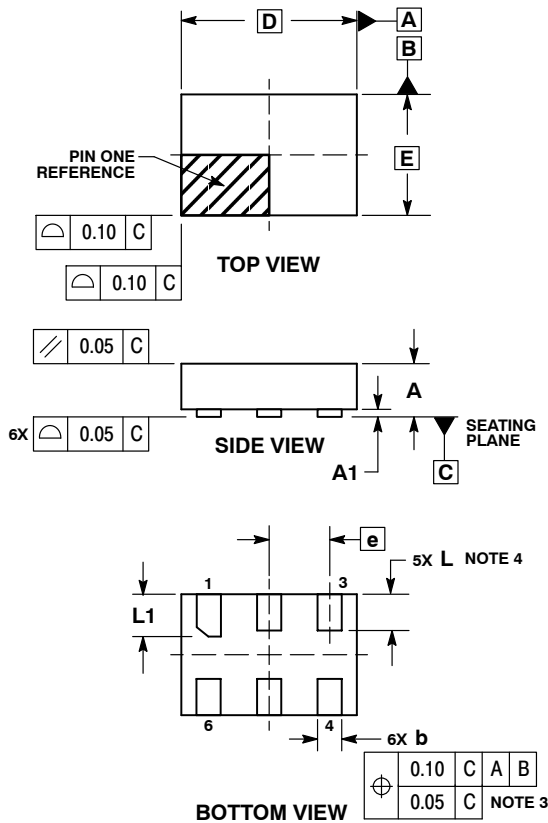
DIMENSIONS: MILLIMETERS

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NLU1GT125

PACKAGE DIMENSIONS

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

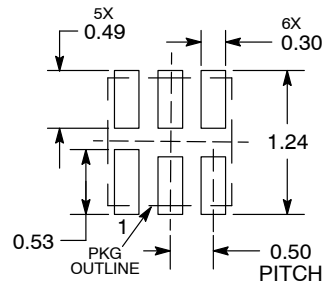


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MILLIMETERS		
DIM	MIN	MAX
A	---	0.40
A1	0.00	0.05
b	0.15	0.25
D	1.45	BSC
E	1.00	BSC
e	0.50	BSC
L	0.25	0.35
L1	0.30	0.40

MOUNTING FOOTPRINT SOLDERMASK DEFINED*



DIMENSIONS: MILLIMETERS

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