

# 1-Bit Dual-Supply Non-Inverting Level Translator

## NLSV1T34

The NLSV1T34 is a 1-bit configurable dual-supply voltage level translator. The input  $A_n$  and output  $B_n$  ports are designed to track two different power supply rails,  $V_{CCA}$  and  $V_{CCB}$  respectively. Both supply rails are configurable from 0.9 V to 4.5 V allowing universal low-voltage translation from the input  $A_n$  to the output  $B_n$  port.

### Features

- Wide  $V_{CCA}$  and  $V_{CCB}$  Operating Range: 0.9 V to 4.5 V
- High-Speed w/ Balanced Propagation Delay
- Inputs and Outputs have OVT Protection to 4.5 V
- Non-preferential  $V_{CCA}$  and  $V_{CCB}$  Sequencing
- Power-Off Protection
- Power-Off High Impedance Inputs and Outputs
- Ultra-Small Packaging: 1.45 mm x 1.0 mm ULLGA6  
2.0 mm x 2.1 mm SC-88A  
1.2 mm x 1.0 mm UDFN6  
1.45 mm x 1.0 mm UDFN6
- 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

### Typical Applications

- Mobile Phones, PDAs, Other Portable Devices

### Important Information

- ESD Protection for All Pins:  
HBM (Human Body Model) > 3000 V

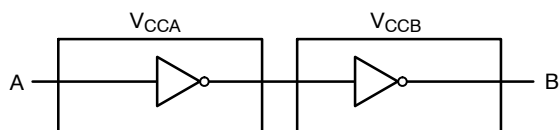


Figure 1. Logic Diagram



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### MARKING DIAGRAMS

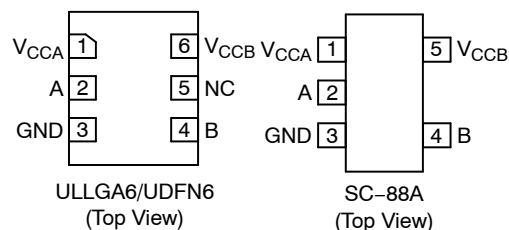
	UDFN6 MU SUFFIX CASE 517AA	
	UDFN6 MU SUFFIX CASE 517AQ	
	ULLGA6 MX1 SUFFIX CASE 613AF	
	SC-88A (SOT-353/SC-70) DF SUFFIX CASE 419A	

Q, A = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

### PIN ASSIGNMENT



### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# NLSV1T34

## PIN ASSIGNMENT

PIN	FUNCTION
V <sub>CCA</sub>	Input Port DC Power Supply
V <sub>CCB</sub>	Output Port DC Power Supply
GND	Ground
A	Input Port
B	Output Port

## TRUTH TABLE

INPUTS	OUTPUTS
A	B
L	L
H	H

## MAXIMUM RATINGS

Symbol	Rating	Value	Condition	Unit
V <sub>CCA</sub> , V <sub>CCB</sub>	DC Supply Voltage	–0.5 to +5.5		V
V <sub>I</sub>	DC Input Voltage A	–0.5 to +5.5		V
V <sub>O</sub>	DC Output Voltage (Power Down) B	–0.5 to +5.5	V <sub>CCA</sub> = V <sub>CCB</sub> = 0	V
	(Active Mode) B	–0.5 to +5.5		V
I <sub>IK</sub>	DC Input Diode Current	–20	V <sub>I</sub> < GND	mA
I <sub>OK</sub>	DC Output Diode Current	–50	V <sub>O</sub> < GND	mA
I <sub>O</sub>	DC Output Source/Sink Current	±50		mA
I <sub>CCA</sub> , I <sub>CCB</sub>	DC Supply Current Per Supply Pin	±100		mA
I <sub>GND</sub>	DC Ground Current per Ground Pin	±100		mA
T <sub>STG</sub>	Storage Temperature	–65 to +150		°C

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.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V <sub>CCA</sub> , V <sub>CCB</sub>	Positive DC Supply Voltage	0.9	4.5	V
V <sub>I</sub>	Bus Input Voltage	GND	4.5	V
V <sub>IO</sub>	Bus Output Voltage (Power Down Mode) B	GND	4.5	V
	(Active Mode) B	GND	V <sub>CCB</sub>	V
T <sub>A</sub>	Operating Temperature Range	–40	+85	°C
Δt / ΔV	Input Transition Rise or Rate V <sub>I</sub> , from 30% to 70% of V <sub>CC</sub> ; V <sub>CC</sub> = 3.3 V ±0.3 V	0	10	nS

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.

# NLSV1T34

## DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V <sub>CCA</sub> (V)	V <sub>CCB</sub> (V)	-40°C to +85°C		Unit
					Min	Max	
V <sub>IH</sub>	Input HIGH Voltage		3.6 – 4.5	0.9 – 4.5	2.2	–	V
			2.7 – 3.6		2.0	–	
			2.3 – 2.7		1.6	–	
			1.4 – 2.3		0.65 * V <sub>CCA</sub>	–	
			0.9 – 1.4		0.9 * V <sub>CCA</sub>	–	
V <sub>IL</sub>	Input LOW Voltage		3.6 – 4.5	0.9 – 4.5	–	0.8	V
			2.7 – 3.6		–	0.8	
			2.3 – 2.7		–	0.7	
			1.4 – 2.3		–	0.35 * V <sub>CCA</sub>	
			0.9 – 1.4		–	0.1 * V <sub>CCA</sub>	
V <sub>OH</sub>	Output HIGH Voltage	I <sub>OH</sub> = –100 µA; V <sub>I</sub> = V <sub>IH</sub>	0.9 – 4.5	0.9 – 4.5	V <sub>CCB</sub> – 0.2	–	V
		I <sub>OH</sub> = –0.5 mA; V <sub>I</sub> = V <sub>IH</sub>	0.9	0.9	0.75 * V <sub>CCB</sub>	–	
		I <sub>OH</sub> = –2 mA; V <sub>I</sub> = V <sub>IH</sub>	1.4	1.4	1.05	–	
		I <sub>OH</sub> = –6 mA; V <sub>I</sub> = V <sub>IH</sub>	1.65	1.65	1.25	–	
			2.3	2.3	2.0	–	
		I <sub>OH</sub> = –12 mA; V <sub>I</sub> = V <sub>IH</sub>	2.3	2.3	1.8	–	
			2.7	2.7	2.2	–	
		I <sub>OH</sub> = –18 mA; V <sub>I</sub> = V <sub>IH</sub>	2.3	2.3	1.7	–	
			3.0	3.0	2.4	–	
		I <sub>OH</sub> = –24 mA; V <sub>I</sub> = V <sub>IH</sub>	3.0	3.0	2.2	–	
V <sub>OL</sub>	Output LOW Voltage	I <sub>OL</sub> = 100 µA; V <sub>I</sub> = V <sub>IL</sub>	0.9 – 4.5	0.9 – 4.5	–	0.2	V
		I <sub>OL</sub> = 0.5 mA; V <sub>I</sub> = V <sub>IH</sub>	1.1	1.1	–	0.3	
		I <sub>OL</sub> = 2 mA; V <sub>I</sub> = V <sub>IH</sub>	1.4	1.4	–	0.35	
		I <sub>OL</sub> = 6 mA; V <sub>I</sub> = V <sub>IL</sub>	1.65	1.65	–	0.3	
		I <sub>OL</sub> = 12 mA; V <sub>I</sub> = V <sub>IL</sub>	2.3	2.3	–	0.4	
			2.7	2.7	–	0.4	
		I <sub>OL</sub> = 18 mA; V <sub>I</sub> = V <sub>IL</sub>	2.3	2.3	–	0.6	
			3.0	3.0	–	0.4	
		I <sub>OL</sub> = 24 mA; V <sub>I</sub> = V <sub>IL</sub>	3.0	3.0	–	0.55	
I <sub>I</sub>	Input Leakage Current	V <sub>I</sub> = V <sub>CCA</sub> or GND	0.9 – 4.5	0.9 – 4.5	–1.0	1.0	µA
I <sub>CCA</sub>	Quiescent Supply Current	V <sub>I</sub> = V <sub>CCA</sub> or GND; I <sub>O</sub> = 0, V <sub>CCA</sub> = V <sub>CCB</sub>	0.9 – 4.5	0.9 – 4.5	–	2.0	µA
I <sub>CCB</sub>	Quiescent Supply Current	V <sub>I</sub> = V <sub>CCA</sub> or GND; I <sub>O</sub> = 0, V <sub>CCA</sub> = V <sub>CCB</sub>	0.9 – 4.5	0.9 – 4.5	–	2.0	µA
I <sub>CCA</sub> + I <sub>CCB</sub>	Quiescent Supply Current	V <sub>I</sub> = V <sub>CCA</sub> or GND; I <sub>O</sub> = 0, V <sub>CCA</sub> = V <sub>CCB</sub>	0.9 – 4.5	0.9 – 4.5	–	4.0	µA
I <sub>OFF</sub>	Power OFF Leakage Current	V <sub>I</sub> = 4.5 V	0	0	–	5.0	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.

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## TOTAL STATIC POWER CONSUMPTION ( $I_{CCA} + I_{CCB}$ )

V <sub>CCA</sub> (V)	-40°C to +85°C										Unit
	V <sub>CCB</sub> (V)										
	4.5		3.3		2.8		1.8		0.9		
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
4.5		2		2		2		2		< 1.5	μA
3.3		2		2		2		2		< 1.5	μA
2.8		< 2		< 1		< 1		< 0.5		< 0.5	μA
1.8		< 1		< 1		< 0.5		< 0.5		< 0.5	μA
0.9		< 0.5		< 0.5		< 0.5		< 0.5		< 0.5	μA

NOTE: Connect ground before applying supply voltage  $V_{CCA}$  or  $V_{CCB}$ . This device is designed with the feature that the power-up sequence of  $V_{CCA}$  and  $V_{CCB}$  will not damage the IC.

## AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V <sub>CCA</sub> (V)	-40°C to +85°C										Unit
			V <sub>CCB</sub> (V)										
			4.5		3.3		2.8		1.8		1.2		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub> (Note 1)	Propagation Delay, A to B	4.5		1.6		1.8		2.0		2.1		2.3	nS
		3.3		1.7		1.9		2.1		2.3		2.6	
		2.8		1.9		2.1		2.3		2.5		2.8	
		1.8		2.1		2.4		2.5		2.7		3.0	
		1.2		2.4		2.7		2.8		3.0		3.3	

1. Propagation delays defined per Figure 2.

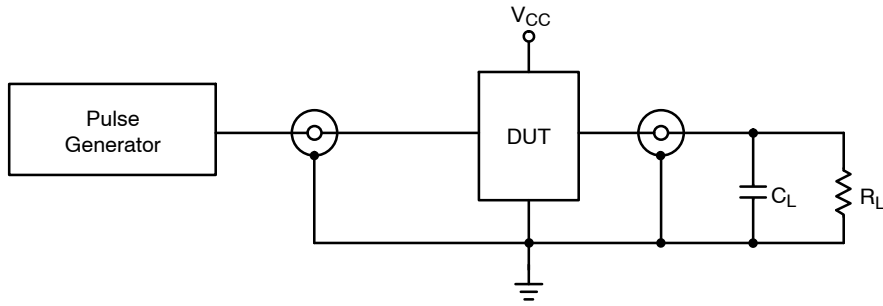
## CAPACITANCE

Symbol	Parameter	Test Conditions	Typ (Note 2)	Unit
$C_{I/O}$	I/O Pin Input Capacitance	$V_{CCA} = V_{CCB} = 3.3$ V, $V_I = 0$ V or $V_{CCA/B}$	5.0	pF
$C_{PD}$	Power Dissipation Capacitance	$V_{CCA} = V_{CCB} = 3.3$ V, $V_I = 0$ V or $V_{CCA}$ , $f = 10$ MHz	5.0	pF

2. Typical values are at  $T_A = +25^\circ C$ .

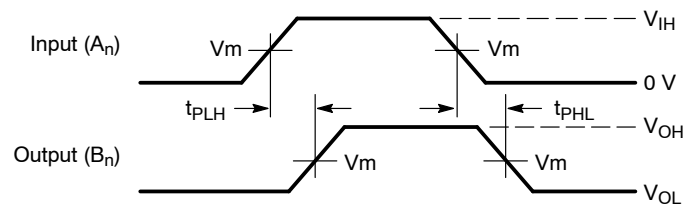
3.  $C_{PD}$  is defined as the value of the IC's equivalent capacitance from which the operating current can be calculated from:  
 $I_{CC(operating)} \cong C_{PD} \times V_{CC} \times f_{IN}$  where  $I_{CC} = I_{CCA} + I_{CCB}$ .

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**Figure 2. AC (Propagation Delay) Test Circuit**

Test	Switch
$C_L = 15 \text{ pF}$ or equivalent (includes probe and jig capacitance) $R_L = 2 \text{ k}\Omega$ or equivalent $Z_{OUT}$ of pulse generator = $50 \Omega$	



**Waveform 1 – Propagation Delays**  
 $t_R = t_F = 2.0 \text{ ns}$ , 10% to 90%;  $f = 1 \text{ MHz}$ ;  $t_W = 500 \text{ ns}$

**Figure 3. AC (Propagation Delay) Test Circuit Waveforms**

Symbol	$V_{CC}$
	$0.9 \text{ V} - 4.5 \text{ V}$
$V_{mA}$	$V_{CCA}/2$
$V_{mB}$	$V_{CCB}/2$

## ORDERING INFORMATION

Device	Package	Shipping†
NLSV1T34MUTBG	UDFN6, 1.2 x 1.0, 0.4P (Pb-Free)	3000 / Tape & Reel
NLSV1T34AMUTAG	UDFN6, 1.45 x 1.0, 0.5P (Pb-Free)	3000 / Tape & Reel
NLSV1T34AMUTCG		
NLSV1T34AMX1TCG	ULLGA6 (Pb-Free)	3000 / Tape & Reel
NLSV1T34DFT2G	SC-88A (Pb-Free)	3000 / Tape & Reel
NLSV1T34DFT2G*		

†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

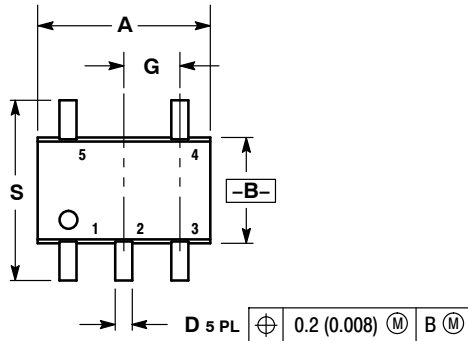
# NLSV1T34

## PACKAGE DIMENSIONS

SC-88A (SC-70-5/SOT-353)

CASE 419A-02

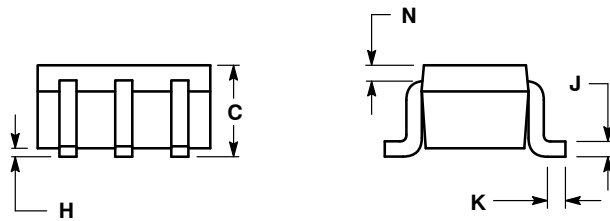
ISSUE L



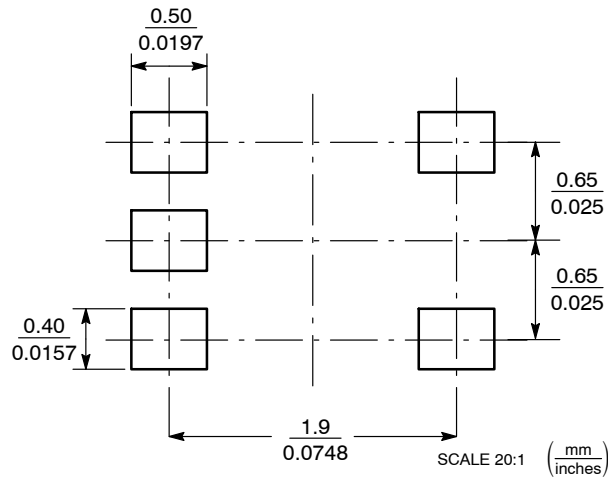
### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.071	0.087	1.80	2.20
B	0.045	0.053	1.15	1.35
C	0.031	0.043	0.80	1.10
D	0.004	0.012	0.10	0.30
G	0.026 BSC		0.65 BSC	
H	---	0.004	---	0.10
J	0.004	0.010	0.10	0.25
K	0.004	0.012	0.10	0.30
N	0.008 REF		0.20 REF	
S	0.079	0.087	2.00	2.20



## SOLDER FOOTPRINT

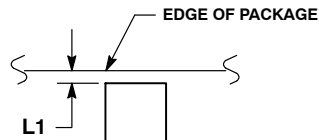
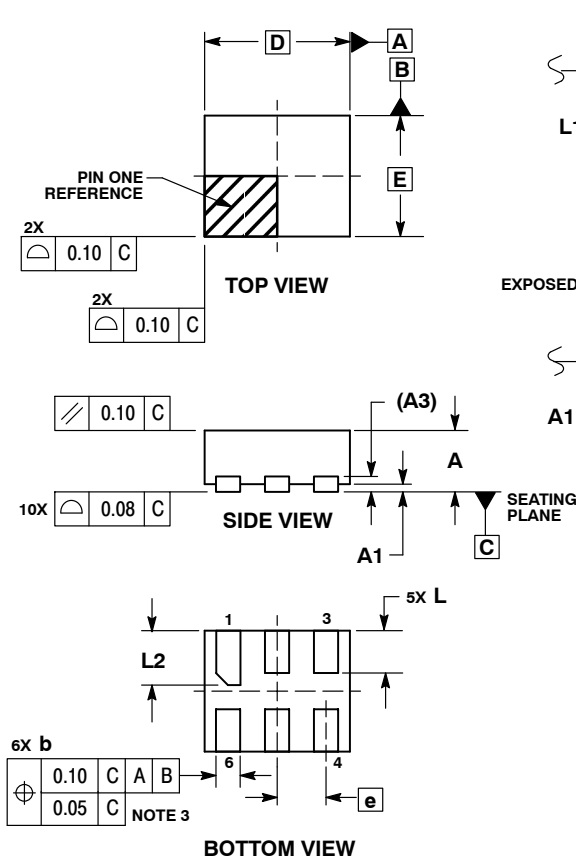


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

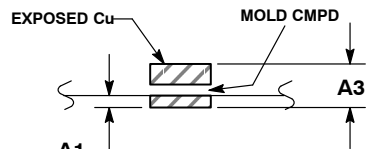
# NLSV1T34

## PACKAGE DIMENSIONS

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



**DETAIL A**  
Bottom View  
(Optional)



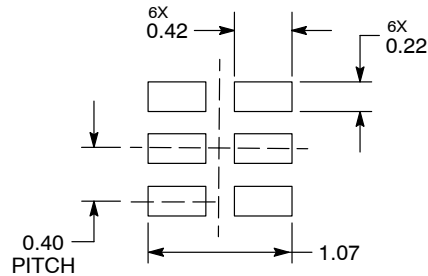
**DETAIL B**  
Side View  
(Optional)

### 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.

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\*



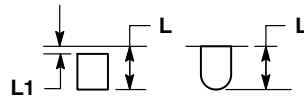
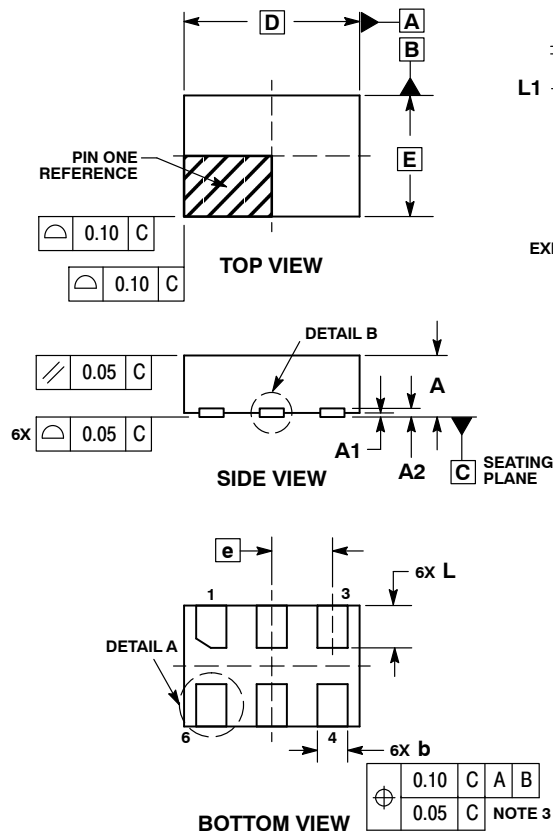
DIMENSIONS: MILLIMETERS

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

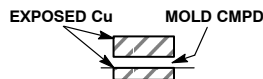
# NLSV1T34

## PACKAGE DIMENSIONS

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



**DETAIL A**  
OPTIONAL  
CONSTRUCTIONS



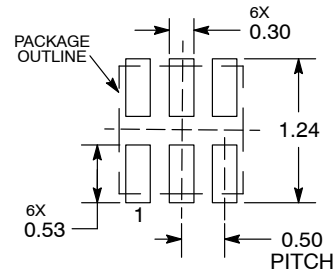
**DETAIL B**  
OPTIONAL  
CONSTRUCTIONS

### 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

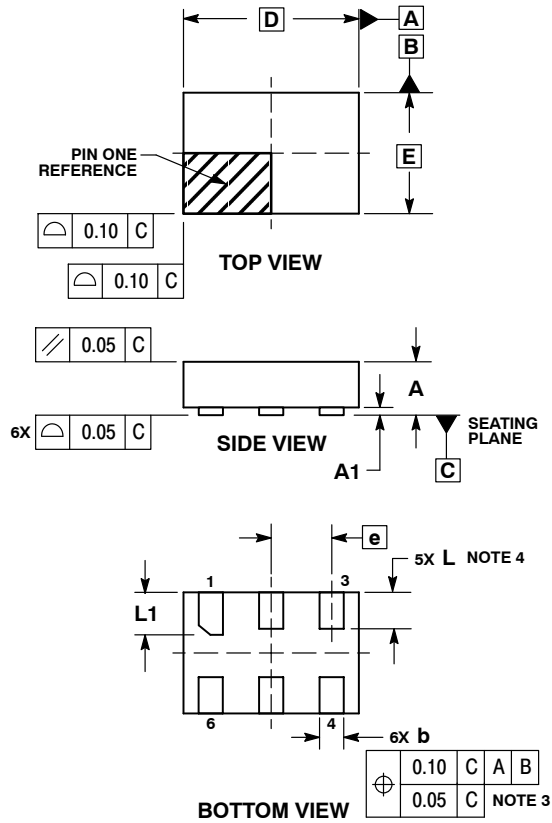
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



# NLSV1T34

## PACKAGE DIMENSIONS

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

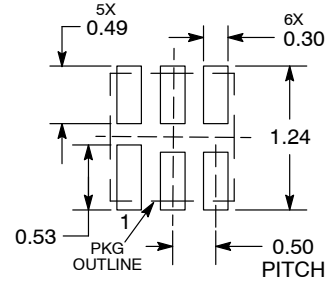


### NOTES:

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.

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

\*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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