

NLSV1T244

1-Bit Dual-Supply Non-Inverting Level Translator

The NLSV1T244 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
- Outputs at 3-State until Active V_{CC} is Reached
- Power-Off Protection
- Outputs Switch to 3-State with V_{CCB} at GND
- Ultra-Small Packaging: 1.2 mm x 1.0 mm UDFN6
- NLVSV 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

Typical Applications

- Mobile Phones, PDAs, Other Portable Devices

Important Information

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

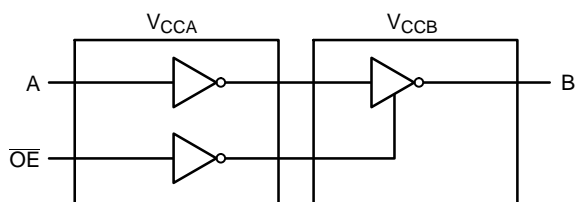


Figure 1. Logic Diagram



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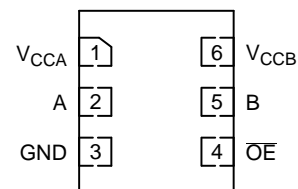
1
UDFN6
MU SUFFIX
CASE 517AA

MARKING DIAGRAM



Q = Specific Device Code
M = Date Code

PIN ASSIGNMENT



(Top View)

ORDERING INFORMATION

Device	Package	Shipping†
NLSV1T244MUTBG, NLVSV1T244MUTBG	UDFN6 (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 Specification Brochure, BRD8011/D.

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PIN ASSIGNMENT

PIN	FUNCTION
V _{CCA}	Input Port DC Power Supply
V _{CCB}	Output Port DC Power Supply
GND	Ground
A	Input Port
B	Output Port
\overline{OE}	Output Enable

TRUTH TABLE

Inputs		Outputs
\overline{OE}	A	B
L	L	L
L	H	H
H	X	3-State

MAXIMUM RATINGS

Symbol	Rating	Value	Condition	Unit	
V _{CCA} , V _{CCB}	DC Supply Voltage	-0.5 to +5.5		V	
V _I	DC Input Voltage	A	-0.5 to +5.5	V	
V _C	Control Input	\overline{OE}	-0.5 to +5.5	V	
V _O	DC Output Voltage (Power Down)	B	-0.5 to +5.5	V _{CCA} = V _{CCB} = 0	V
	(Active Mode)	B	-0.5 to +5.5		V
	(Tri-State Mode)	B	-0.5 to +5.5		V
I _{IK}	DC Input Diode Current		-20	V _I < GND	mA
I _{OK}	DC Output Diode Current		-50	V _O < GND	mA
I _O	DC Output Source/Sink Current		±50		mA
I _{CCA} , I _{CCB}	DC Supply Current Per Supply Pin		±100		mA
I _{GND}	DC Ground Current per Ground Pin		±100		mA
T _{STG}	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 _{CCA} , V _{CCB}	Positive DC Supply Voltage	0.9	4.5	V	
V _I	Bus Input Voltage	GND	4.5	V	
V _C	Control Input	\overline{OE}	GND	4.5	V
V _{IO}	Bus Output Voltage (Power Down Mode)	B	GND	4.5	V
	(Active Mode)	B	GND	V _{CCB}	V
	(Tri-State Mode)	B	GND	4.5	V
T _A	Operating Temperature Range	-40	+85	°C	
Δt / ΔV	Input Transition Rise or Rate V _I , from 30% to 70% of V _{CC} ; V _{CC} = 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.

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DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CCA} (V)	V _{CCB} (V)	-40°C to +85°C		Unit
					Min	Max	
V _{IH}	Input HIGH Voltage (A, OE)		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 _{CCA}	–	
			0.9 – 1.4		0.9 * V _{CCA}	–	
V _{IL}	Input LOW Voltage (A, OE)		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 _{CCA}	
			0.9 – 1.4		–	0.1 * V _{CCA}	
V _{OH}	Output HIGH Voltage	I _{OH} = -100 μA; V _I = V _{IH}	0.9 – 4.5	0.9 – 4.5	V _{CCB} - 0.2	–	V
		I _{OH} = -0.5 mA; V _I = V _{IH}	0.9	0.9	0.75 * V _{CCB}	–	
		I _{OH} = -2 mA; V _I = V _{IH}	1.4	1.4	1.05	–	
		I _{OH} = -6 mA; V _I = V _{IH}	1.65	1.65	1.25	–	
			2.3	2.3	2.0	–	
		I _{OH} = -12 mA; V _I = V _{IH}	2.3	2.3	1.8	–	
			2.7	2.7	2.2	–	
		I _{OH} = -18 mA; V _I = V _{IH}	2.3	2.3	1.7	–	
3.0	3.0		2.4	–			
V _{OL}	Output LOW Voltage	I _{OL} = 100 μA; V _I = V _{IL}	0.9 – 4.5	0.9 – 4.5	–	0.2	V
		I _{OL} = 0.5 mA; V _I = V _{IL}	1.1	1.1	–	0.3	
		I _{OL} = 2 mA; V _I = V _{IL}	1.4	1.4	–	0.35	
		I _{OL} = 6 mA; V _I = V _{IL}	1.65	1.65	–	0.3	
			2.3	2.3	–	0.4	
		I _{OL} = 12 mA; V _I = V _{IL}	2.7	2.7	–	0.4	
			2.3	2.3	–	0.6	
		I _{OL} = 18 mA; V _I = V _{IL}	3.0	3.0	–	0.4	
3.0	3.0		–	0.55			
I _I	Input Leakage Current	V _I = V _{CCA} or GND	0.9 – 4.5	0.9 – 4.5	-1.0	1.0	μA
I _{OFF}	Power-Off Leakage Current	OE = 0 V	0 0.9 – 4.5	0.9 – 4.5 0	-1.0 -1.0	1.0 1.0	μA
I _{CCA}	Quiescent Supply Current	V _I = V _{CCA} or GND; I _O = 0, V _{CCA} = V _{CCB}	0.9 – 4.5	0.9 – 4.5	–	1.0	μA
I _{CCB}	Quiescent Supply Current	V _I = V _{CCA} or GND; I _O = 0, V _{CCA} = V _{CCB}	0.9 – 4.5	0.9 – 4.5	–	1.0	μA
I _{CCA} + I _{CCB}	Quiescent Supply Current	V _I = V _{CCA} or GND; I _O = 0, V _{CCA} = V _{CCB}	0.9 – 4.5	0.9 – 4.5	–	2.0	μA
ΔI _{CCA}	Increase in I _{CC} per Input Voltage, Other Inputs at V _{CCA} or GND	V _I = V _{CCA} - 0.6 V; V _I = V _{CCA} or GND	4.5	4.5	–	10	μA
			3.6	3.6	–	5.0	
ΔI _{CCB}	Increase in I _{CC} per Input Voltage, Other Inputs at V _{CCA} or GND	V _I = V _{CCA} - 0.6 V; V _I = V _{CCA} or GND	4.5	4.5	–	10	μA
			3.6	3.6	–	5.0	
I _{OZ}	I/O Tri-State Output Leakage Current	T _A = 25°C, OE = 0 V	0.9 – 4.5	0.9 – 4.5	-1.0	1.0	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_{CCA} (V)	-40°C to +85°C										Unit
	V_{CCB} (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	μ A
3.3		2		2		2		2		< 1.5	μ A
2.8		< 2		< 1		< 1		< 0.5		< 0.5	μ A
1.8		< 1		< 1		< 0.5		< 0.5		< 0.5	μ A
0.9		< 0.5		< 0.5		< 0.5		< 0.5		< 0.5	μ A

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_{CCA} (V)	-40°C to +85°C										Unit
			V_{CCB} (V)										
			4.5		3.3		2.8		1.8		1.2		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t_{PLH} , t_{PHL} (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	
t_{PZH} , t_{PZL} (Note 1)	Output Enable, \bar{O} to B	4.5		2.6		3.8		4.0		4.1		4.3	nS
		3.3		3.7		3.9		4.1		4.3		4.6	
		2.5		3.9		4.1		4.3		4.5		4.8	
		1.8		4.1		4.4		4.5		4.7		5.0	
		1.2		4.4		4.7		4.8		5.0		5.3	
t_{PHZ} , t_{PLZ} (Note 1)	Output Disable, \bar{OE} to B	4.5		2.6		3.8		4.0		4.1		4.3	nS
		3.3		3.7		3.9		4.1		4.3		4.6	
		2.5		3.9		4.1		4.3		4.5		4.8	
		1.8		4.1		4.4		4.5		4.7		5.0	
		1.2		4.4		4.7		4.8		5.0		5.3	
t_{OSHL} , t_{OSLH} (Note 1)	Output to Output Skew, Tim	4.5		0.15		0.15		0.15		0.15		0.15	nS
		3.3		0.15		0.15		0.15		0.15		0.15	
		2.5		0.15		0.15		0.15		0.15		0.15	
		1.8		0.15		0.15		0.15		0.15		0.15	
		1.2		0.15		0.15		0.15		0.15		0.15	

1. Propagation delays defined per Figure 2.

CAPACITANCE

Symbol	Parameter	Test Conditions	Typ (Note 2)	Unit
C_{IN}	Control Pin Input Capacitance	$V_{CCA} = V_{CCB} = 3.3$ V, $V_I = 0$ V or $V_{CCA/B}$	3.5	pF
$C_{I/O}$	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 $T_A = +25^\circ\text{C}$.

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

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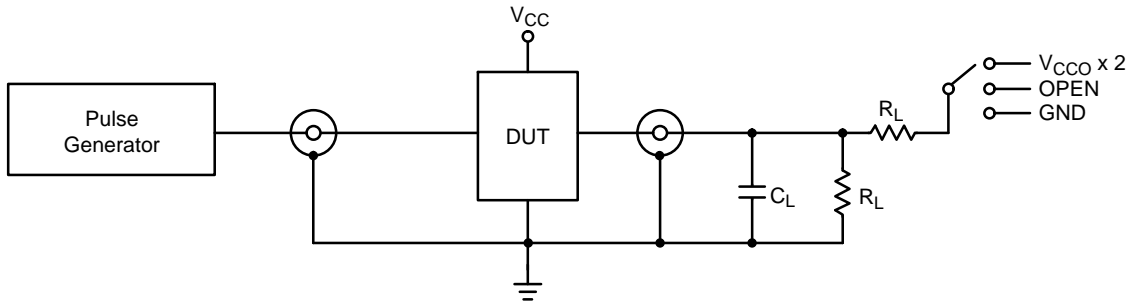
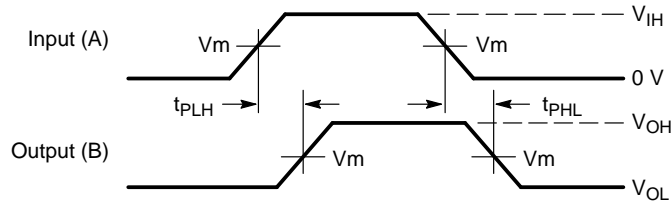


Figure 2. AC (Propagation Delay) Test Circuit

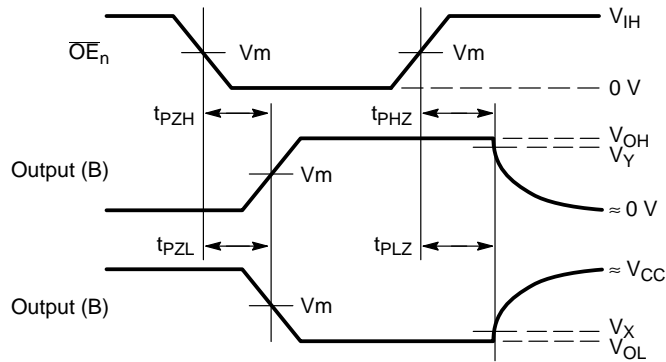
Test	Switch
t_{PLH} , t_{PHL}	OPEN
t_{PLZ} , t_{PZL}	$V_{CCO} \times 2$
t_{PHZ} , t_{PZH}	GND

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



Waveform 1 – Propagation Delays

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



Waveform 2 – Output Enable and Disable Times

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

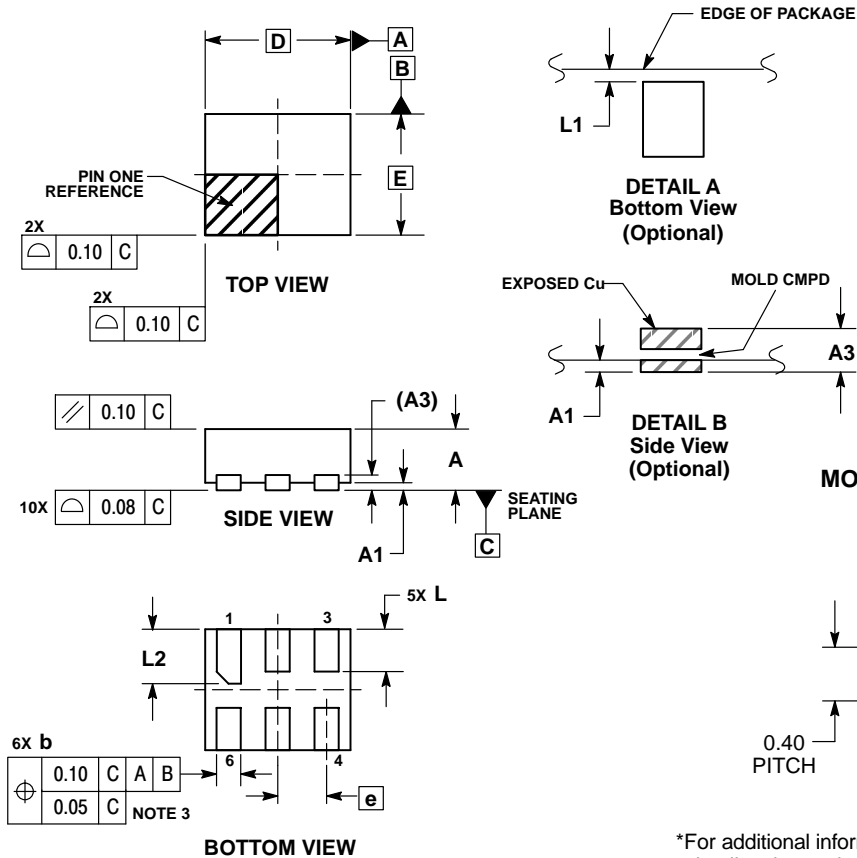
Figure 3. AC (Propagation Delay) Test Circuit Waveforms

Symbol	V_{CC}				
	3.0 V – 4.5 V	2.3 V – 2.7 V	1.65 V – 1.95 V	1.4 V – 1.6 V	0.9 V – 1.3 V
V_{mA}	$V_{CCA}/2$	$V_{CCA}/2$	$V_{CCA}/2$	$V_{CCA}/2$	$V_{CCA}/2$
V_{mB}	$V_{CCB}/2$	$V_{CCB}/2$	$V_{CCB}/2$	$V_{CCB}/2$	$V_{CCB}/2$
V_X	$V_{OL} \times 0.1$	$V_{OL} \times 0.1$	$V_{OL} \times 0.1$	$V_{OL} \times 0.1$	$V_{OL} \times 0.1$
V_Y	$V_{OH} \times 0.9$	$V_{OH} \times 0.9$	$V_{OH} \times 0.9$	$V_{OH} \times 0.9$	$V_{OH} \times 0.9$

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PACKAGE DIMENSIONS

UDFN6 1.2 x 1.0, 0.4P
CASE 517AA
ISSUE D

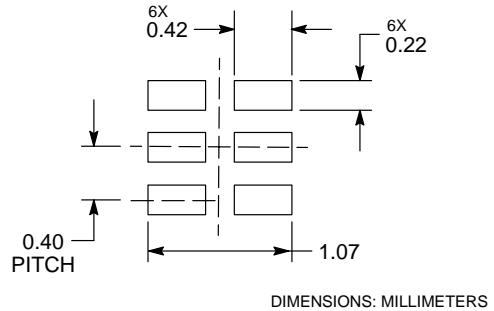


NOTES:

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*



*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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