

NLSV4T2244

Product Preview Dual 2-Bit Dual-Supply Non-Inverting Level Translator

The NLSV4T2244 is a dual 2-bit configurable dual-supply bus buffer level translator. The ports A and B are designed to track two different power supply rails V_{CCA} and V_{CCB} , respectively. Both supply rails are configurable from 1.2 V to 4.1 V allowing universal low-voltage translation from the input port to the output port.

Features

- Wide V_{CCA} and V_{CCB} Operating Range: 1.2 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
- Ultra-Small packaging: 1.7mm x 2.0 mm UQFN-12

Typical Applications

- Mobile Phones, PDAs, Other Portable Devices

Important Information

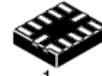
- ESD Protection for All Pins:
HBM (Human Body Model) > 8000 V



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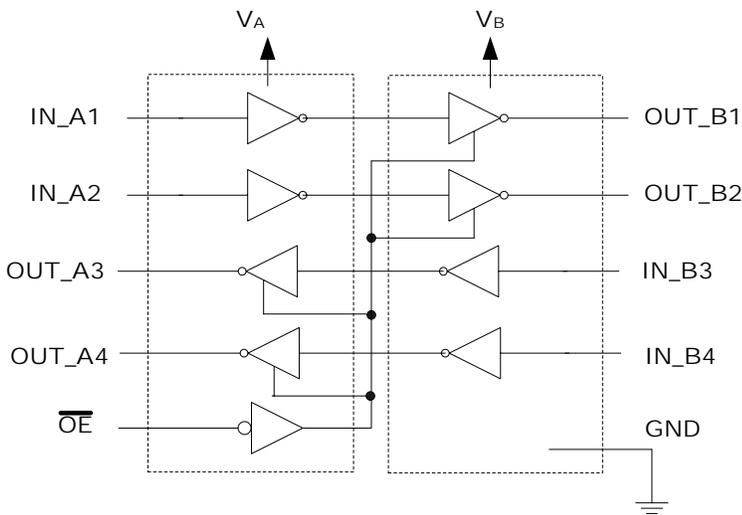
UQFN12, 1.7 mm x 2.0 mm



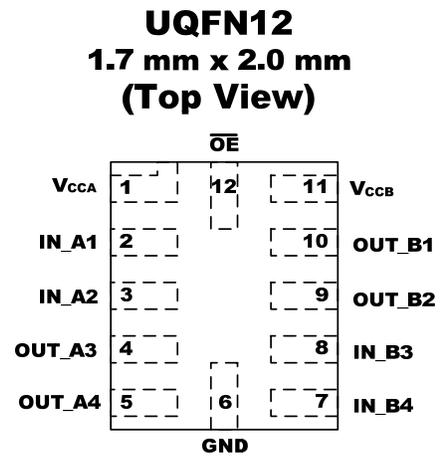
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UQFN-12
MU SUFFIX
CASE 523AE

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimension section.



Logic Diagram



Pin Assignments

NLSV4T244

Pin Names	
Pins	Description
V _{CCA}	'A' DC Power Supply
V _{CCB}	'B' DC Power Supply
GND	Ground
IN_A1, IN_A2	Input (Referenced to V _A)
IN_B3, IN_B4	Input (Referenced to V _B)
OUT_B1, OUT_B2	Output (Referenced to V _B)
OUT_A3 OUT_A4	Output (Referenced to V _A)
\overline{OE}	Output Enable (Referenced to V _A)

Truth Table		
Inputs		Outputs
\overline{OE}	IN_A1, IN_A2, IN_A3, IN_A4	OUT_B1, OUT_B2, OUT_B3, OUT_B4
H	X	3-State
L	L	L
	H	H

MAXIMUM RATINGS

Symbol	Parameter	Value	Condition	Unit	
V _{CCA} , V _{CCB}	DC Supply Voltage	-0.5 to +5.5		V	
V _I	DC Input Voltage	IN_xn	-0.5 to +5.5	V	
V _C	Control Input	OE	-0.5 to +5.5	V	
V _O	DC Output Voltage (Power Down)	OUT_xn	-0.5 to +5.5	V _{CCA} = V _{CCB} = 0	V
	(Active Mode)	OUT_xn	-0.5 to +5.5		V
	(Tri-State Mode)	OUT_xn	-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 "Maximum Ratings" may damage the device. "Maximum Ratings" are stress ratings only. Functional operation above "Recommended Operating Conditions" is not implied. Extended exposure to stresses above "Recommended Operating Conditions" may affect device reliability.

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RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CCA}, V_{CCB}	Positive DC Supply Voltage	1.2	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) OUT_{x_n}	GND	4.5	V
	(Active Mode) OUT_{x_n}	GND	4.5	V
	(Tri-State Mode) OUT_{x_n}	GND	4.5	V
T_A	Operating Temperature Range	-55	+125	°C
$\Delta t / \Delta V$	Input Transition Rise or Rate V_I , from 30% to 70% of V_{CC} ; $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	0	10	nS

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DC Electrical Characteristics

Symbol	Parameter	Test Conditions	V _{CCA} (V)	V _{CCB} (V)	-55°C to +125°C		Unit
					Min	Max	
V _{IH}	Input HIGH Voltage		3.6 – 4.5	1.2 – 4.5	TBD	-	V
			2.7 – 3.6		2.0	-	
			2.3 – 2.7		1.6	-	
			1.4 -2.3		0.65 * V _{CCA}	-	
			1.2 – 1.4		0.9 * V _{CCA}	-	
V _{IL}	Input LOW Voltage		3.6 – 4.5	1.2 – 4.5	-	TBD	V
			2.7 – 3.6		-	0.8	
			2.3 – 2.7		-	0.7	
			1.4 -2.3		-	0.35 * V _{CCA}	
			1.2 – 1.4		-	0.1 * V _{CCA}	
V _{OH}	Output HIGH Voltage	I _{OH} = -100 μA; V _I = V _{IH}	1.2 – 4.5	1.2 – 4.5	V _{CCB} – 0.2	-	V
		I _{OH} = -0.5 mA; V _I = V _{IH}	1.2	1.2	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}	1.2 – 4.5	1.2 – 4.5	-	0.2	V
		I _{OL} = 0.5 mA; V _I = V _{IH}	1.2	1.2	-	0.3 * V _{CCB}	
		I _{OL} = 2 mA; V _I = V _{IH}	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}	2.3	2.3	-	0.4	
			2.7	2.7	-	0.4	
		I _{OL} = 18 mA; V _I = V _{IL}	2.3	2.3	-	0.6	
3.0	3.0		-	0.4			
I _{OL} = 24 mA; V _I = V _{IL}	2.3	2.3	-	0.6			
	3.0	3.0	-	0.55			
I _I	Input Leakage Current	V _I = V _{CCA} or GND	1.2 – 4.5	1.2 – 4.5	-1.0	+1.0	μA
I _{OFF}	Power-Off Leakage Current	V _I or V _O = 0 to 4.5 V	1.2 – 4.5	0	-1.0	+1.0	μA
			0	1.2 – 4.5			
I _{OZ}	I/O Tri-State Output Leakage Current	T _A = 25°C, \overline{OE} = GND	1.2 – 4.5	1.2 – 4.5		2.0	μA
I _{CCA}	Quiescent Supply Current	V _I = V _{CCA} or GND; I _O = 0	1.2 – 4.5	1.2 – 4.5		2.0	μA
I _{CCB}	Quiescent Supply Current	V _I = V _{CCB} or GND; I _O = 0	1.2 – 4.5	1.2 – 4.5		2.0	μA
I _{CCA} + I _{CCB}	Quiescent Supply Current	V _I = V _{CCA} or GND; I _O = 0	1.2 – 4.5	1.2 – 4.5		4.0	μA

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DC Electrical Characteristics (Continued)

Symbol	Parameter	Test Conditions	V _{CCA} (V)	V _{CCB} (V)	-55°C to +125°C		Unit
					Min	Max	
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		10.0	μA
			3.6	3.6		5.0	
ΔI _{CCB}	Increase in I _{CC} per Input Voltage, Other Inputs at V _{CCB} or GND	V _I = V _{CCA} - 0.6 V; V _I = V _{CCA} or GND	4.5	4.5		10.0	μA
			3.6	3.6		5.0	

Total Static Power Consumption (I_{CCA} + I_{CCB})

V _{CCA} (V)	-55°C to +125°C										Unit
	V _{CCB} (V)										
	4.5		3.6		2.8		1.8		1.2		
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
4.5		2		2		2		2		< 1	μA
3.6		2		2		2		2		< 1	μA
2.8		< 2		< 1		< 1		< 0.5		< 0.5	μA
1.8		< 1		< 1		< 0.5		< 0.5		< 0.5	μA
1.2		< 1		< 1		< 0.5		< 0.5		< 0.5	μA

Notes: 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.

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AC Electrical Characteristics

		-55°C to +125°C											
		V _{CCB} (V)											
Symbol	Parameter	V _{CCA} (V)	4.5		3.6		2.8		1.8		1.2		Unit
			Min	Max									
t _{PLH} , t _{PHL}	Propagation Delay, A _n to B _n	4.5		1.6		1.8		2.0		2.1		2.3	nS
		3.6		1.7		1.9		2.1		2.3		2.5	
		2.8		1.9		2.1		2.3		2.5		2.7	
		1.8		2.1		2.4		2.5		2.7		2.9	
		1.2		2.4		2.7		2.8		3.0		3.2	
t _{PZH} , t _{PZL}	Output Enable, OE to OUT _{xn}	4.5		2.6		3.8		4.0		4.1		4.3	nS
		3.6		3.7		3.9		4.1		4.3		4.5	
		2.8		3.9		4.1		4.3		4.5		4.7	
		1.8		4.1		4.4		4.5		4.7		4.9	
		1.2		4.4		4.7		4.8		5.0		5.2	
t _{PHZ} , t _{PLZ}	Output Disable, OE to OUT _{xn}	4.5		2.6		3.8		4.0		4.1		4.3	nS
		3.6		3.7		3.9		4.1		4.3		4.5	
		2.8		3.9		4.1		4.3		4.5		4.7	
		1.8		4.1		4.4		4.5		4.7		4.9	
		1.2		4.4		4.7		4.8		5.0		5.2	
t _{OSHL} , t _{OSLH}	Output to Output Skew, Data to Output	4.5		0.15		0.15		0.15		0.15		0.15	nS
		3.6		0.15		0.15		0.15		0.15		0.15	
		2.8		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	

Notes: Propagation delays defined per Figure 1.

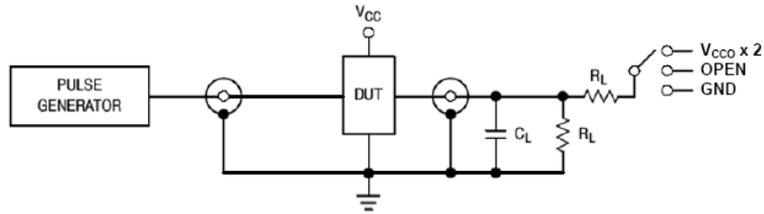
Capacitance

Symbol	Parameter	Test Conditions	Typ ⁽¹⁾	Unit
C _{IN}	Control Pin Input Capacitance	V _{CCA} =V _{CCB} =3.3 V, V _I = 0V or V _{CCA/B}	3.5	pF
C _{I/O}	I/O Pin Input Capacitance	V _{CCA} =V _{CCB} =3.3 V, V _I =0V 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	10	pF

Notes:

1. Typical values are at T_A = +25 °C
2. CPD is defined as the value of the IC's equivalent capacitance from which the operating current can be calculated from: I_{CC(operating)} ≅ C_{PD} × V_{CC} × f_{IN} × N_{SW} where I_{CC} = I_{CCA} + I_{CCB} and N_{SW} = total number of outputs switching

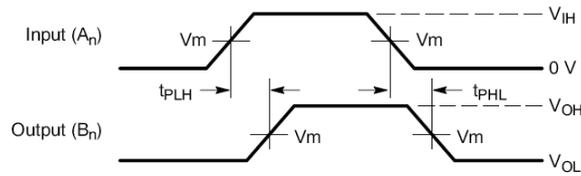
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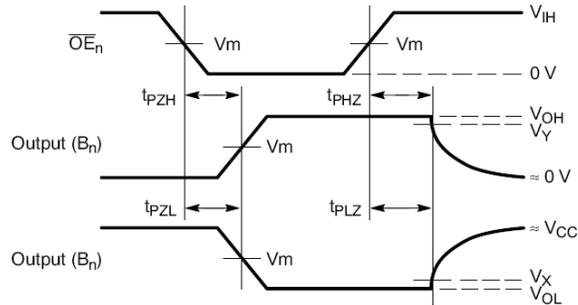
Test	Switch
t_{PLH} , t_{PHL}	OPEN
t_{PLZ} , t_{PZL}	$V_{CC0} \times 2$
t_{PHZ} , t_{PZH}	GND

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

Figure 1. AC (Propagation Delay) Test Circuit



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%; $f = 1 \text{ MHz}$; $t_W = 500 \text{ ns}$

Symbol	V_{CC}
	1.2 – 4.5 V
V_{mA}	$V_{CCA}/2$
V_{mB}	$V_{CCB}/2$
V_X	$V_{OL} \times 0.1$
V_Y	$V_{OH} \times 0.9$

Figure 2: AC Waveforms

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DEVICE ORDERING INFORMATION

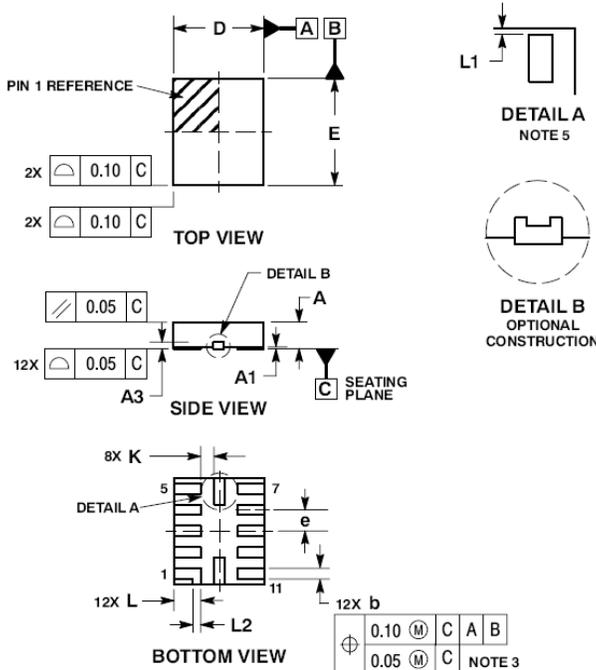
Device Order Number	Package Type	Tape & Reel Size†
NLSV4T2244MUTAG	UQFN-12 (Pb-Free)	3000 Units/Reel

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

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PACKAGE DIMENSIONS

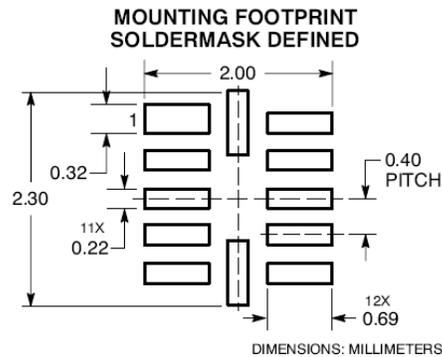
UQFN12 1.7x2.0, 0.4P
CASE 523AE-01
ISSUE A



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 TERMINAL TIP.
4. MOLD FLASH ALLOWED ON TERMINALS ALONG EDGE OF PACKAGE. FLASH 0.03 MAX ON BOTTOM SURFACE OF TERMINALS.
5. DETAIL A SHOWS OPTIONAL CONSTRUCTION FOR 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	1.70 BSC	
E	2.00 BSC	
e	0.40 BSC	
K	0.20	----
L	0.45	0.55
L1	0.00	0.03
L2	0.15 REF	



*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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