

NLSV2T240

2-Bit Dual-Supply Inverting Level Translator

The NLSV2T240 is a 2-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: 1.8 mm x 1.2 mm UDFN8
- This is a Pb-Free Device

Typical Applications

- Mobile Phones, PDAs, Other Portable Devices

Important Information

- ESD Protection for All Pins:
HBM (Human Body Model) > 5000 V

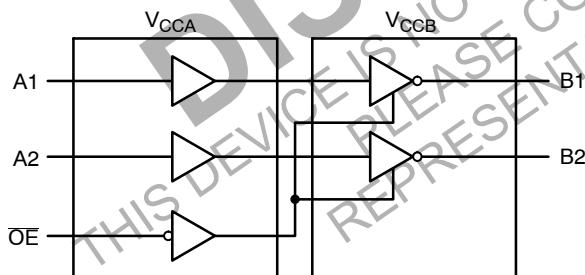
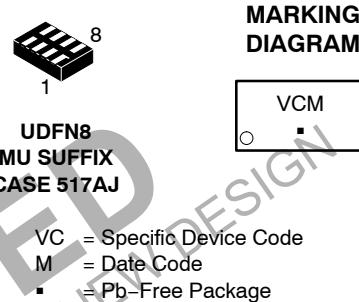


Figure 1. Logic Diagram

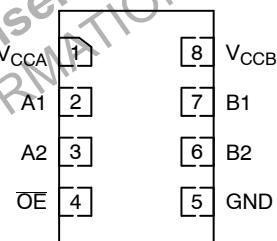


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PIN ASSIGNMENT



ORDERING INFORMATION

Device	Package	Shipping [†]
NLSV2T240MUTAG	UDFN8 (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.

PIN ASSIGNMENT

PIN	FUNCTION
V_{CCA}	Input Port DC Power Supply
V_{CCB}	Output Port DC Power Supply
GND	Ground
A_n	Input Port
B_n	Output Port
\overline{OE}	Output Enable

TRUTH TABLE

Inputs		Outputs
\overline{OE}	A_n	B_n
L	L	H
L	H	L
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_n	-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_n	-0.5 to +5.5	$V_{CCA} = V_{CCB} = 0$
	(Active Mode)	B_n	-0.5 to +5.5	V
	(Tri-State Mode)	B_n	-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 the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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_O	Bus Output Voltage (Power Down Mode)	B_n	GND	4.5	V
	(Active Mode)	B_n	GND	V_{CCB}	V
	(Tri-State Mode)	B_n	GND	4.5	V
T_A	Operating Temperature Range	-40	+85	°C	
$\Delta t / \Delta V$	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	

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 (An, 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 (An, 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 _{IL}	0.9 – 4.5	0.9 – 4.5	V _{CCB} – 0.2	–	V	
		I _{OH} = -0.5 mA; V _I = V _{IL}	0.9	0.9	0.75 * V _{CCB}	–		
		I _{OH} = -2 mA; V _I = V _{IL}	1.4	1.4	1.05	–		
		I _{OH} = -6 mA; V _I = V _{IL}	1.65	1.65	1.25	–		
			2.3	2.3	2.0	–		
		I _{OH} = -12 mA; V _I = V _{IL}	2.3	2.3	1.8	–		
			2.7	2.7	2.2	–		
		I _{OH} = -18 mA; V _I = V _{IL}	2.3	2.3	1.7	–		
			3.0	3.0	2.4	–		
		I _{OH} = -24 mA; V _I = V _{IL}	3.0	3.0	2.2	–		
V _{OL}	Output LOW Voltage	I _{OL} = 100 µA; V _I = V _{IH}	0.9 – 4.5	0.9 – 4.5	–	0.2	V	
		I _{OL} = 0.5 mA; V _I = V _{IH}	1.1	1.1	–	0.3		
		I _{OL} = 2 mA; V _I = V _{IH}	1.4	1.4	–	0.35		
		I _{OL} = 6 mA; V _I = V _{IH}	1.65	1.65	–	0.3		
		I _{OL} = 12 mA; V _I = V _{IH}	2.3	2.3	–	0.4		
			2.7	2.7	–	0.4		
		I _{OL} = 18 mA; V _I = V _{IH}	2.3	2.3	–	0.6		
			3.0	3.0	–	0.4		
	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 3.6	4.5 3.6	–	10 5.0	µA
	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 3.6	4.5 3.6	–	10 5.0	µA
	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

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	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_{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_n to B_n	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, OE to B_n	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, OE to B_n	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, Time	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	20	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:
 $I_{CC(\text{operating})} \cong C_{PD} \times V_{CC} \times f_{IN} \times N_{SW}$ where $I_{CC} = I_{CCA} + I_{CCB}$ and N_{SW} = total number of outputs switching.

NLSV2T240

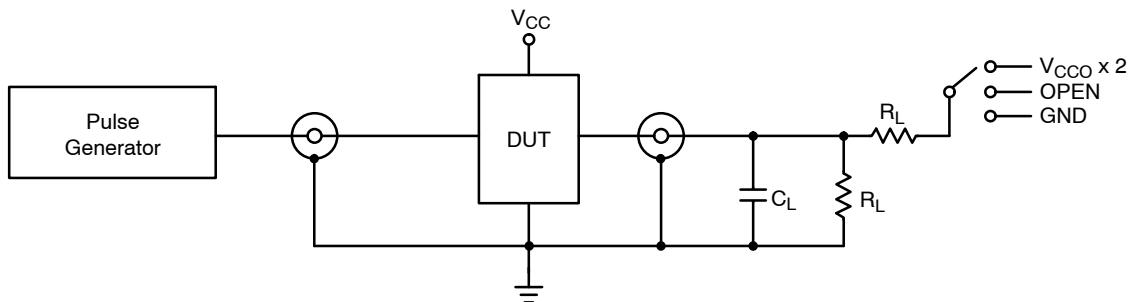
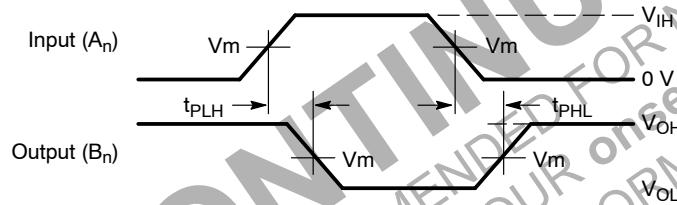


Figure 2. AC (Propagation Delay) Test Circuit

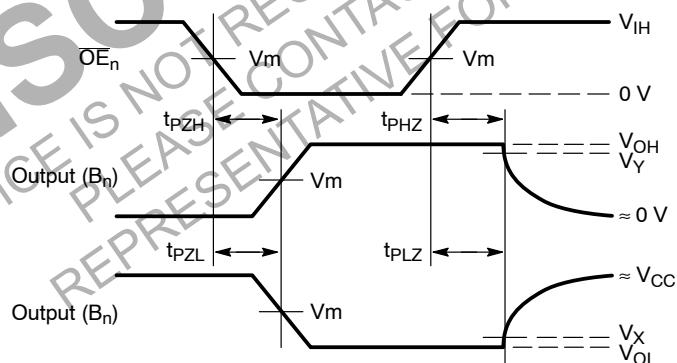
Test	Switch
t_{PLH}, t_{PHL}	OPEN
t_{PLZ}, t_{PZL}	$V_{CCO} \times 2$
t_{PHZ}, t_{PZH}	GND

$C_L = 15 \text{ pF}$ 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

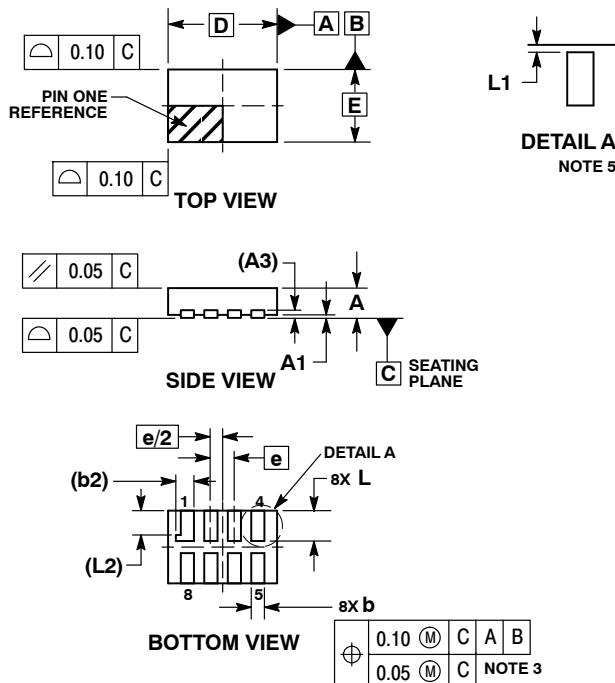
Symbol	V_{CC}				
	3.0 V – 4.5 V	2.3 V – 2.7 V	1.65 V – 1.95 V	1.4 V – 1.6 V	0.9 V – 1.3 V
V_{mA}	$V_{CCA}/2$	$V_{CCA}/2$	$V_{CCA}/2$	$V_{CCA}/2$	$V_{CCA}/2$
V_{mB}	$V_{CCB}/2$	$V_{CCB}/2$	$V_{CCB}/2$	$V_{CCB}/2$	$V_{CCB}/2$
V_X	$V_{OL} \times 0.1$				
V_Y	$V_{OH} \times 0.9$				



SCALE 4:1

UDFN8 1.8x1.2, 0.4P
CASE 517AJ
ISSUE O

DATE 08 NOV 2006



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 MAY NOT EXCEED 0.03 onto 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
b2	0.30 REF	
D	1.80 BSC	
E	1.20 BSC	
L	0.45	0.55
L1	0.00	0.03
L2	0.40 REF	

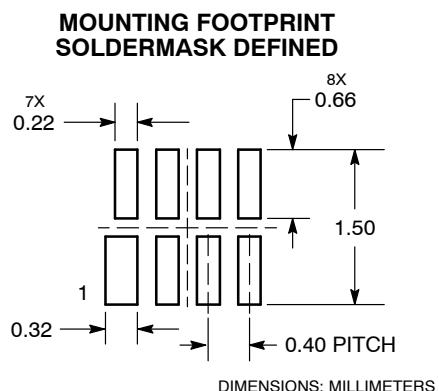
GENERIC
MARKING DIAGRAM*

XX = Specific Device Code

M = Date Code

■ = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking.
Pb-Free indicator, "G" or microdot "■", may or may not be present.



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