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NLSV4T3234

4-Bit Dual-Supply Bus Buffer Level Translator with 26 Ω Output Series Resistor

The NLSV4T3234 is a 4−bit configurable dual−supply voltage level translator. The input (B−) and output (A−) ports are designed to track two different power supply rails, V_{CCB} and V_{CCA} respectively. Both supply rails are configurable from 0.9 V to 4.5 V, allowing high−to−low and low−to high voltage translation from the input (B−) to the output (A−) port.

The NLSV4T3234 is a low power voltage translator that contains series output resistors, and overvoltage tolerant (OVT) input and output protection. The 26 Ω series resistor on the output drivers minimizes ringing on the logic transition edges. The OVT feature allows the NLSV4T3234 to translate input signals greater than the input power supply V_{CCB} and protects the IC from damage if a signal is connected to an output pin that is greater than V_{CCA}.

Features

- Wide V_{CCA} and V_{CCB} Operating Range: 0.9 V to 4.5 V
- High−Speed Logic Voltage Translation
- 26 Ω Series Resistors on Outputs (A−) Reduce Ground Bounce and Overshoot
- Overvoltage Tolerant (OVT) Inputs and Outputs to 4.5 V
- Non−preferential Power Supply Sequencing
- Outputs At 3−State Until Active V_{CC} Is Reached
- Outputs Switch to 3−State with V_{CCA} at GND
- Ultra−Small Packaging: 1.41 mm x 2.04 mm Flip−Chip11
- RoHS Compliant
- This is a Pb−Free Device*

Typical Applications

- Mobile Phones, PDAs, Other Portable Devices

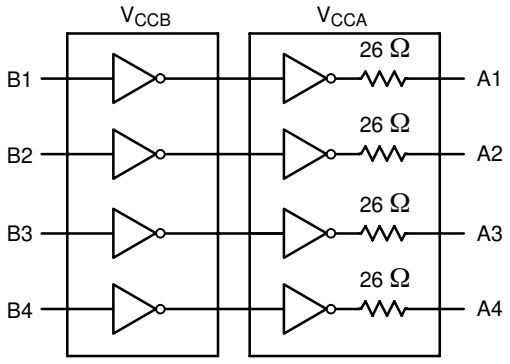

Figure 1. Logic Diagram

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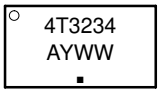
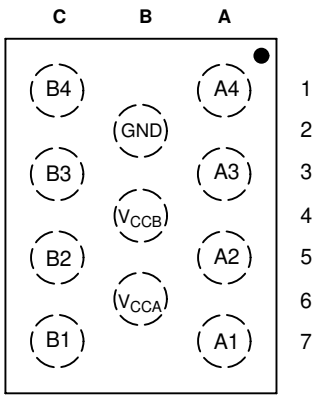
MARKING DIAGRAM

11 PIN FLIP−CHIP
FC SUFFIX
CASE 766AJ



4T3234 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

PIN ASSIGNMENT



(Top View)

ORDERING INFORMATION

Device	Package	Shipping†
NLSV4T3234FCT1G	Flip−Chip11 (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.

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

PIN NAMES

PIN	Description
V_{CCB}	Input Port DC Power Supply
V_{CCA}	Output Port DC Power Supply
GND	Ground
B_n	Input Port
A_n	Output Port

TRUTH TABLE

Inputs (B_n)	Outputs (A_n)
L	L
H	H

PIN DESCRIPTION

Pin	Symbol	Description
A1	A4	Data Output
A3	A3	Data Output
A5	A2	Data Output
A7	A1	Data Output
B2	GND	Ground
B4	V_{CCB}	Input Power Supply
B6	V_{CCA}	Output Power Supply
C1	B4	Data Input
C3	B3	Data Input
C5	B2	Data Input
C7	B1	Data Input

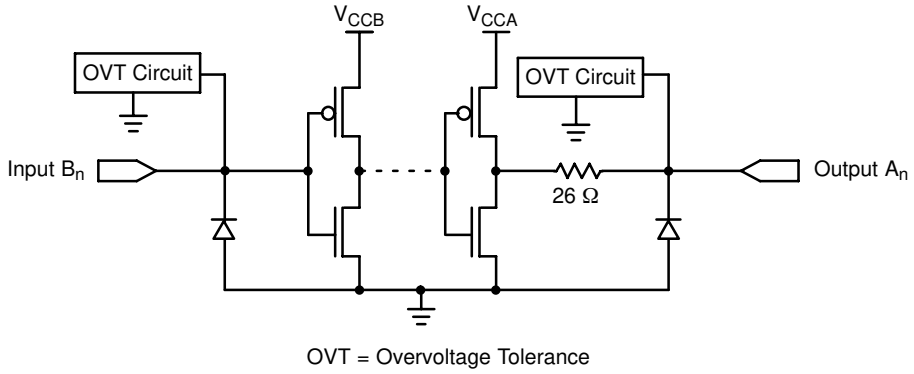


Figure 2. Simplified Input and Output Circuit Schematic

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	(Power Down)	B_n	−0.5 to +5.5	$V_{CCA} = V_{CCB} = 0$	V
		(Active Mode)	B_n	−0.5 to +5.5		
V_O	DC Output Voltage	(Power Down)	A_n	−0.5 to +5.5	$V_{CCA} = V_{CCB} = 0$	V
		(Active Mode)	A_n	−0.5 to +5.5		V
I_{IK}	DC Input Diode Current			−20		mA
I_{OK}	DC Output Diode Current			−50	$V_O > V_{CC}$; $V_O <$ 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_{IB}	Bus Input Voltage (B_n)		GND	4.5	V
V_{IA}	Bus Output Voltage (A_n)	(Power Down Mode)	GND	4.5	V
		(Active Mode)	GND	V_{CCA}	V
T_A	Operating Temperature Range		−40	+85	°C
$\Delta t / \Delta V$	Input Transition Rise or Rate (Note 1)	V_{CCB} = 3.6 to 4.5 V	0	10	nS/V
		V_{CCB} = 2.3 to 3.5 V	0	20	nS/V
		V_{CCB} = 0.9 to 2.2 V	0	100	nS/V

1. V_I from 0.8 V to 2.0 V at V_{CC} = 3.0 V

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V_{CCB} (V)	V_{CCA} (V)	Test Conditions	–40°C to +85°C		Unit
					Min	Max	
V_{IHB}	Input HIGH Voltage	3.6 – 4.5	0.9 – 4.5		2.3	–	V
		2.7 – 3.6			2.0	–	
		2.3 – 2.7			1.6	–	
		1.4 –2.3			0.65 * V_{CCB}	–	
		0.9 – 1.4			0.9 * V_{CCB}	–	
V_{ILB}	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_{CCB}	
		0.9 – 1.4			–	0.1 * V_{CCB}	
V_{OHA}	Output HIGH Voltage	0.9 – 4.5	0.9 – 4.5	I_{OH} = –100 μA; V_I = V_{IH}	V_{CCA} – 0.2	–	V
			0.9	I_{OH} = –0.5 mA; V_I = V_{IH}	0.75 * V_{CCA}	–	
			1.4	I_{OH} = –2 mA; V_I = V_{IH}	1.05	–	
			1.65	I_{OH} = –6 mA; V_I = V_{IH}	1.25	–	
			2.3		2.0	–	
			2.3	I_{OH} = –12 mA; V_I = V_{IH}	1.8	–	
			2.7		2.2	–	
			2.3	I_{OH} = –18 mA; V_I = V_{IH}	1.7	–	
			3.0		2.4	–	
			3.0	I_{OH} = –24 mA; V_I = V_{IH}	2.2	–	
V_{OLA}	Output LOW Voltage	0.9 – 4.5	0.9 – 4.5	I_{OL} = 100 μA; V_I = V_{IL}	–	0.2	V
			1.1	I_{OL} = 0.5 mA; V_I = V_{IH}	–	0.3 * V_{CCA}	
			1.4	I_{OL} = 2 mA; V_I = V_{IH}	–	0.35	
			1.65	I_{OL} = 6 mA; V_I = V_{IL}	–	0.3	
			2.3	I_{OL} = 12 mA; V_I = V_{IL}	–	0.4	
			2.7		–	0.4	
			2.3	I_{OL} = 18 mA; V_I = V_{IL}	–	0.6	
			3.0		–	0.4	
			3.0	I_{OL} = 24 mA; V_I = V_{IL}	–	0.55	
I_I	Input Leakage Current	0.9 – 4.5	0.9 – 4.5	V_I = V_{CCB} or GND	–	±1.0	μA
I_{OFF}	Power–Off Leakage Current	0	0	V_I or V_O = 0 to 4.5 V	–	±3.0	μA
I_{CCA}, I_{CCB}	Quiescent Supply Current	0.9 – 4.5	0.9 – 4.5	V_I = V_{CCB} or GND; I_O = 0	–	±1.5	μA
I_{CCA} + I_{CCB}	Quiescent Supply Current	0.9 – 4.5	0.9 – 4.5	V_I = V_{CCB} or GND; I_O = 0	–	±3.0	μA
ΔI_{CCB}	Increase in I_{CC} per Input Voltage, Other Inputs at V_{CC} or GND	4.5	4.5	V_I = V_{CCB} – 0.6 V; V_I = V_{CCB} or GND	–	500.0	μA

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V_{CCB} (V)	–40°C to +85°C										Unit
			V_{CCA} (V)										
			1.5		1.8		2.8		3.3		4.5		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t_{PLH}, t_{PHL}	Propagation Delay B_n to A_n (C_L = 15 pF, R_L = 2 kΩ) (Note 2)	1.5	–	5.2	–	4.5	–	3.9	–	3.8	–	3.7	nS
		1.8	–	4.9	–	4.3	–	3.8	–	3.4	–	3.5	
		2.8	–	4.7	–	4.2	–	3.4	–	3.3	–	3.2	
		3.3	–	4.6	–	4.0	–	3.4	–	3.3	–	3.1	
		4.5	–	4.6	–	4.0	–	3.5	–	3.3	–	3.1	
t_{PLH}, t_{PHL}	Propagation Delay B_n to A_n (C_L = 30 pF, R_L = 2 kΩ) (Note 2)	1.5	–	5.6	–	4.8	–	4.2	–	4.2	–	4.5	nS
		1.8	–	5.4	–	4.6	–	3.9	–	3.9	–	3.8	
		2.8	–	5.2	–	4.4	–	3.7	–	3.7	–	3.3	
		3.3	–	5.1	–	4.1	–	3.6	–	3.6	–	3.2	
		4.5	–	5.1	–	3.8	–	3.1	–	3.0	–	3.0	
t_{OSLH}, t_{OSHL}	Output to Output Skew Time (Notes 3 & 4)	1.5	–	0.2	–	0.2	–	0.2	–	0.2	–	0.2	nS
		1.8	–	0.2	–	0.2	–	0.2	–	0.2	–	0.2	
		2.8	–	0.2	–	0.2	–	0.2	–	0.2	–	0.2	
		3.3	–	0.2	–	0.2	–	0.2	–	0.2	–	0.2	
		4.5	–	0.2	–	0.2	–	0.2	–	0.2	–	0.2	

2. Propagation delays defined per Figure 3.
3. Skew is defined as the absolute value of the difference between the actual propagation delay for any two outputs of the same device switching in the same direction, either HIGH or LOW (t_{OSLH} = | t_{PLHm} – t_{PLHn} |, t_{OSHL} = | t_{PHLm} – t_{PHLn} |).
4. Parameter guaranteed by design.

DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Parameter	T_A = 25 °C			Typ	Unit
		V_{CCB} (V)	V_{CCA} (V)	Test Conditions		
V_{OLPA}	Dynamic Low Level Quiet An Output (overshoot)	1.8	1.8	C_L = 30 pF, V_{IL} = 0V, V_{IH} = V_{CCB}	0.1	V
		2.8	2.8		0.25	
		3.6	3.6		0.35	
V_{OLVA}	Dynamic Low Level Quiet An Output (ground bounce)	1.8	1.8	C_L = 30 pF, V_{IL} = 0V, V_{IH} = V_{CCB}	–0.1	V
		2.8	2.8		–0.25	
		3.6	3.6		–0.35	
V_{OHVA}	Dynamic Low Level Quiet An Output	1.8	1.8	C_L = 30 pF, V_{IL} = 0V, V_{IH} = V_{CCB}	1.6	V
		2.8	2.8		2.6	
		3.6	3.6		3.3	

CAPACITANCE

Symbol	Parameter	Test Conditions	Typ (Note 5)	Unit
C_{IN}	Input Capacitance	V_{CCA} = V_{CCB} = 3.3 V, V_I = 0 V or V_{CCB}	3.5	pF
C_O	Output Capacitance	V_{CCA} = V_{CCB} = 3.3 V, V_I = 0 V or V_{CCB}	5.0	pF
C_{PD}	Power Dissipation Capacitance (Note 6)	V_{CCA} = V_{CCB} = 1.8, 2.8 or 3.6 V, V_I = 0 V or V_{CCB}, f = 1 MHz	28	pF

5. Typical values are at T_A = +25°C
6. C_{PD} is defined as the value of the IC's equivalent capacitance from which the operating current can be calculated from: $I_{CC(operating)}$ = C_{PD} x V_{CC} x f_{IN} + I_{CC}/4 (per circuit).

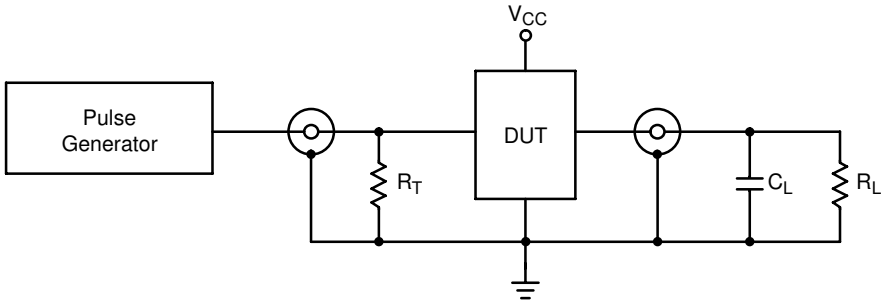
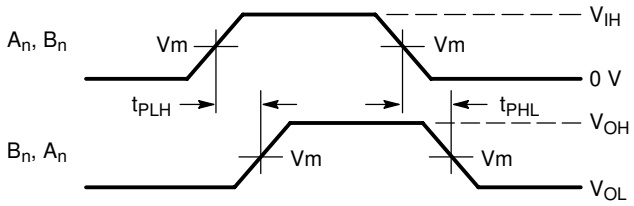


Figure 3. AC (Propagation Delay) Test Circuit

Test
t_{PLH}, t_{PHL}, t_{OSLH}, t_{OSHL}
C_L = 15 pF / 30 pF or equivalent (includes probe and jig capacitance) R_L = 2 kΩ or equivalent Z_{OUT} of pulse generator = 50 Ω R_T = 50 Ω



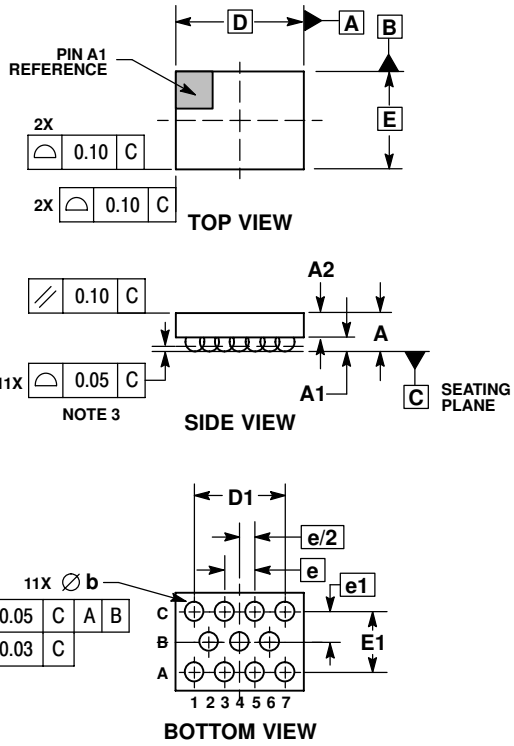
Waveform 1 – Propagation Delays
t_R = t_F = 2.0 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns

Figure 4. AC Waveforms

Symbol	V_{CC}
	1.5 V, 1.8 V, 2.8 V, 3.3 V, 4.5 V
V_{mA}	$V_{CCA}/2$
V_{mB}	$V_{CCB}/2$

PACKAGE DIMENSIONS

11 PIN FLIP−CHIP, 2.04x1.41, 0.5P
CASE 766AJ−01
ISSUE O



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

	MILLIMETERS	
DIM	MIN	MAX
A	−−−	0.66
A1	0.21	0.27
A2	0.33	0.39
b	0.29	0.34
D	2.04 BSC	
D1	1.50 BSC	
E	1.41 BSC	
E1	0.86 BSC	
e	0.50 BSC	
e1	0.43 BSC	

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