

# ON Semiconductor

## Is Now

# onsemi™

To learn more about onsemi™, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

**onsemi** and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.

# 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-Chip<sup>11</sup>
- RoHS Compliant
- This is a Pb-Free Device\*

### Typical Applications

- Mobile Phones, PDAs, Other Portable Devices

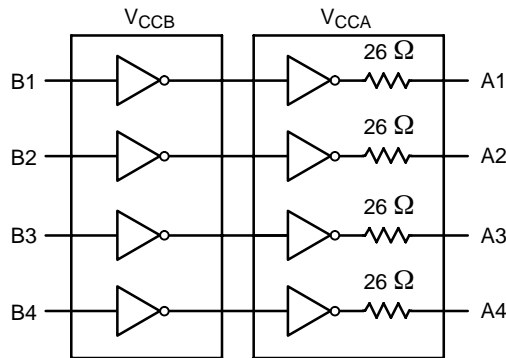


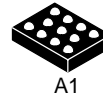
Figure 1. Logic Diagram



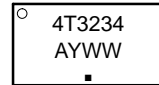
ON Semiconductor®

<http://onsemi.com>

### MARKING DIAGRAM

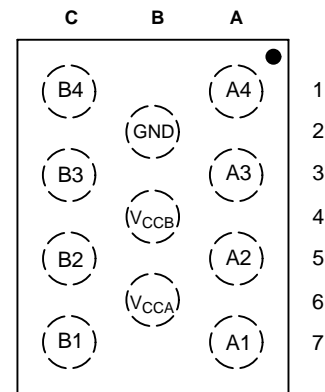


11 PIN FLIP-CHIP  
FC SUFFIX  
CASE 766AJ



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.

# NLSV4T3234

## PIN NAMES

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

## TRUTH TABLE

Inputs (B <sub>n</sub> )	Outputs (A <sub>n</sub> )
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 <sub>CCB</sub>	Input Power Supply
B6	V <sub>CCA</sub>	Output Power Supply
C1	B4	Data Input
C3	B3	Data Input
C5	B2	Data Input
C7	B1	Data Input

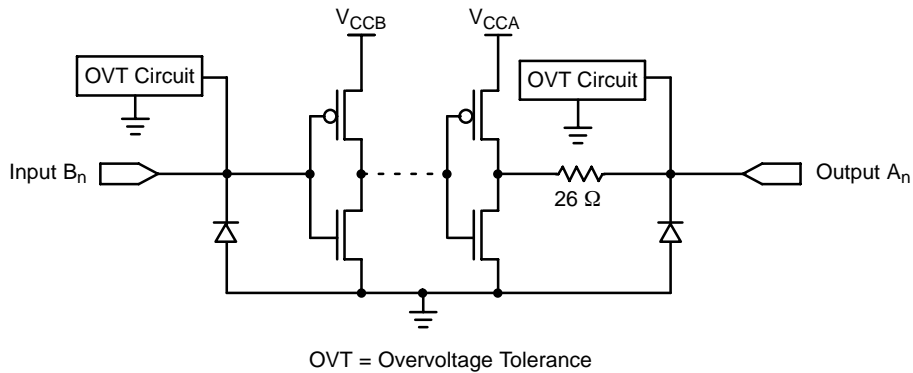


Figure 2. Simplified Input and Output Circuit Schematic

# NLSV4T3234

## 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	$\pm 50$		mA
$I_{CCA}, I_{CCB}$	DC Supply Current Per Supply Pin	$\pm 100$		mA
$I_{GND}$	DC Ground Current per Ground Pin	$\pm 100$		mA
$T_{STG}$	Storage Temperature	-65 to +150		$^{\circ}C$

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	$^{\circ}C$	
$\Delta t / \Delta V$	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

# NLSV4T3234

## DC ELECTRICAL CHARACTERISTICS

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

# NLSV4T3234

## AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	V <sub>CCB</sub> (V)	-40°C to +85°C										Unit
			V <sub>CCA</sub> (V)										
			1.5		1.8		2.8		3.3		4.5		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay B <sub>n</sub> to A <sub>n</sub> (C <sub>L</sub> = 15 pF, R <sub>L</sub> = 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 <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay B <sub>n</sub> to A <sub>n</sub> (C <sub>L</sub> = 30 pF, R <sub>L</sub> = 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 <sub>OSLH</sub> , t <sub>OSSL</sub>	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<sub>OSLH</sub> = | t<sub>PLHm</sub> - t<sub>PLHn</sub> |, t<sub>OSSL</sub> = | t<sub>PHLm</sub> - t<sub>PHLn</sub> |).

4. Parameter guaranteed by design.

## DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Parameter	T <sub>A</sub> = 25 °C			Typ	Unit
		V <sub>CCB</sub> (V)	V <sub>CCA</sub> (V)	Test Conditions		
V <sub>OLPA</sub>	Dynamic Low Level Quiet An Output (overshoot)	1.8	1.8	C <sub>L</sub> = 30 pF V <sub>IL</sub> = 0V V <sub>IH</sub> = V <sub>CCB</sub>	0.1	V
		2.8	2.8		0.25	
		3.6	3.6		0.35	
V <sub>OLVA</sub>	Dynamic Low Level Quiet An Output (ground bounce)	1.8	1.8	C <sub>L</sub> = 30 pF V <sub>IL</sub> = 0V V <sub>IH</sub> = V <sub>CCB</sub>	-0.1	V
		2.8	2.8		-0.25	
		3.6	3.6		-0.35	
V <sub>OHVA</sub>	Dynamic Low Level Quiet An Output	1.8	1.8	C <sub>L</sub> = 30 pF V <sub>IL</sub> = 0V V <sub>IH</sub> = V <sub>CCB</sub>	1.6	V
		2.8	2.8		2.6	
		3.6	3.6		3.3	

## CAPACITANCE

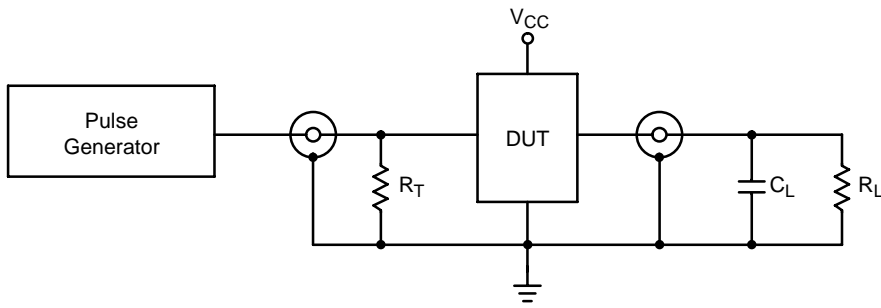
Symbol	Parameter	Test Conditions	Typ (Note 5)	Unit
C <sub>IN</sub>	Input Capacitance	V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CCB</sub>	3.5	pF
C <sub>O</sub>	Output Capacitance	V <sub>CCA</sub> = V <sub>CCB</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CCB</sub>	5.0	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 6)	V <sub>CCA</sub> = V <sub>CCB</sub> = 1.8, 2.8 or 3.6 V, V <sub>I</sub> = 0 V or V <sub>CCB</sub> , f = 1 MHz	28	pF

5. Typical values are at T<sub>A</sub> = +25°C

6. C<sub>PD</sub> is defined as the value of the IC's equivalent capacitance from which the operating current can be calculated from:

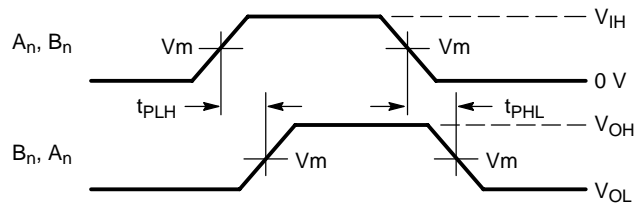
$$I_{CC(\text{operating})} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4 \text{ (per circuit).}$$

# NLSV4T3234



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

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



**Waveform 1 – Propagation Delays**

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

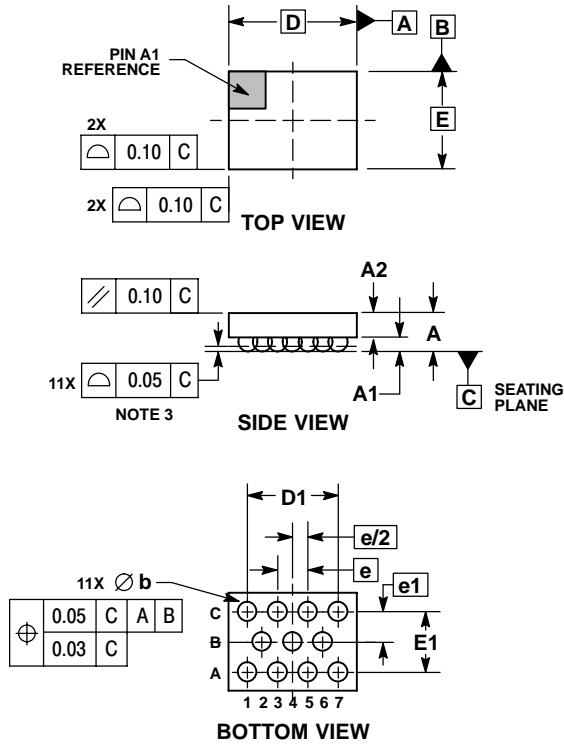
**Figure 4. AC Waveforms**

Symbol	V <sub>CC</sub>
	1.5 V, 1.8 V, 2.8 V, 3.3 V, 4.5 V
V <sub>mA</sub>	V <sub>CCA</sub> /2
V <sub>mB</sub>	V <sub>CCB</sub> /2

# NLSV4T3234

## 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.

DIM	MILLIMETERS	
	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	

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

#### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** orderlit@onsemi.com

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5773-3850

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative

NLSV4T3234/D