

ON Semiconductor

Is Now

onsemi™

To learn more about onsemi™, please visit our website at
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. **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.

NCV7001

Quad Variable Reluctance Sensor Interface IC

The NCV7001 is a four-channel variable reluctance sensor interface IC. Microprocessor control functions include two polarity 5.0 V programmable resets, two programmable watchdog inputs, and an enable function (OLE). Two watchdog inputs allow control from two independent microprocessors.

Open sensor detection capability is provided. During test mode (NTEST = Low), a high on the OLE pin should provide a high on the output. A low under these conditions indicates an open load.

This part has been designed to operate in an automotive environment.

Features

- Four Channel Capability
- Differential Inputs
- Open Sensor Detect
- 5.0 V Supply Operation with RESET and Watchdog Features
- On-Chip Input Voltage Clamping
- NCV Prefix for Automotive and Other Applications Requiring Site and Change Control
- AEC Qualified
- PPAP Capable
- Pb-Free Packages are Available*

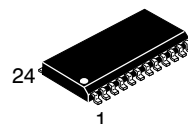
Typical Applications

- Antilock Braking Systems (ABS)
- Traction Control Systems (TCS)
- Vehicle Dynamics Control (VDC)



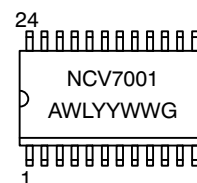
ON Semiconductor®

<http://onsemi.com>



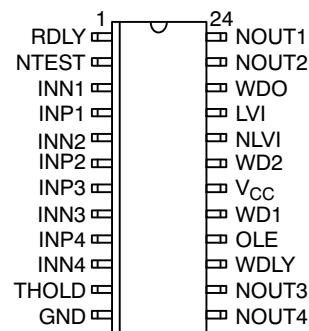
SO-24L
DW SUFFIX
CASE 751E

MARKING DIAGRAM



- A = Assembly Location
- WL = Wafer Lot
- YY = Year
- WW = Work Week
- G = Pb-Free Package

PIN CONNECTIONS



ORDERING INFORMATION

Device	Package	Shipping†
NCV7001DW	SO-24L	30 Units/Rail
NCV7001DWG	SO-24L (Pb-Free)	30 Units/Rail
NCV7001DWR2	SO-24L	1000 Tape & Reel
NCV7001DWR2G	SO-24L (Pb-Free)	1000 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.

NCV7001

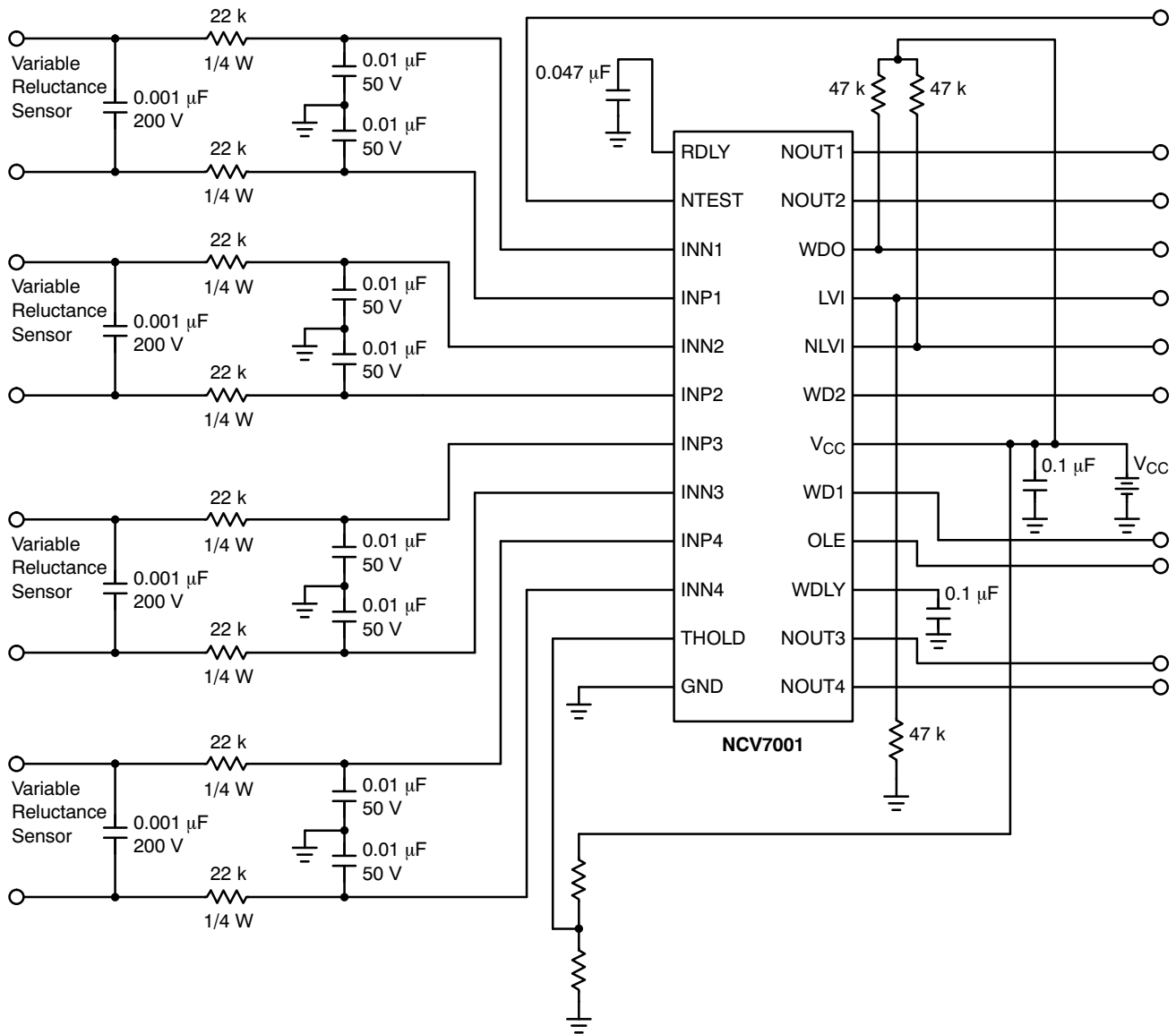


Figure 1. Application Diagram

MAXIMUM RATINGS*

Rating	Value	Unit
DC Supply Voltage (V_{CC})	-0.3 to 7.0	V
Input Clamp Current	-10, 10	mA
ESD Capability (Human Body Model)	2.0	kV
Storage Temperature	-55 to 150	°C
Operating Junction Temperature	-40 to 150	°C
Package Thermal Resistance: Junction-to-Case, $R_{\theta JC}$ Junction-to-Ambient, $R_{\theta JA}$	16 80	°C/W °C/W
Lead Temperature Soldering:	Reflow: (SMD styles only) (Notes 1, 2)	240 peak

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.

*The maximum package power dissipation must be observed.

- 60 second maximum above 183°C.
- 5°C/+0°C allowable conditions.

NCV7001

ELECTRICAL CHARACTERISTICS (4.5 V ≤ V_{CC} ≤ 5.5 V, -40°C ≤ T_J ≤ 125°C; unless otherwise noted.)

Characteristic	Test Conditions	Min	Typ	Max	Unit
General Characteristics					
Quiescent Current	-	-	-	24	mA

Input

Positive Input Threshold	R _{series} = 22 k between INPX & INNX Thold Pin = 0 V	30	45	60	mV
Negative Input Threshold	R _{series} = 22 k between INPX & INNX Thold Pin = 0 V	-60	-45	-30	mV
Positive Input Threshold	R _{series} = 22 k between INPX & INNX Thold Pin = 2.0 V	84	126	168	mV
Negative Input Threshold	R _{series} = 22 k between INPX & INNX Thold Pin = 2.0 V	-168	-126	-84	mV
Positive Input Threshold	R _{series} = 22 k between INPX & INNX ±90 mV at V _{CC} = V _{THOLD} = 4.5 V	110	140	200	mV
Negative Input Threshold	R _{series} = 22 k between INPX & INNX ±90 mV at V _{CC} = V _{THOLD} = 4.5 V	-200	-140	-110	mV
Input Resistance	-	225	400	800	kΩ
Input Bias/Single Ended	Thold = 0 V	0.46 V _{CC}	0.5 V _{CC}	0.54 V _{CC}	V
Input Clamp Current	For Correct Reset & Watchdog During Power Up	-6.0	-	6.0	mA
Input Clamp Voltage	(-10 mA) (+10 mA)	-0.5 V _{CC} - 0.6	0 V _{CC}	0.5 V _{CC} + 0.6	V V
Open Sensor Threshold	22 k in Series with INNX and INPX	12	-	120	kΩ

Output (NOUTX)

Output Low Voltage	I _{OUT} = 1.0 mA	-	0.2	0.4	V
Output High Voltage	I _{OUT} = -100 μA	V _{CC} - 0.7	-	-	V
Output During Test / Normal Sensor (V _{CC} - V _{OUT})	OLE = 1.0, I _{OUT} = -100 μA	-	-	0.7	V
Output During Test / Open Sensor (V _{CC} - V _{OUT})	OLE = 1.0, I _{OUT} = -1.0 mA	-	-	0.4	V
Output (V _{CC} - V _{OUT})	OLE (= Low), I _{OUT} = -100 μA,	-	-	0.7	V
Output (V _{CC} - V _{OUT})	OLE (= 1.0)/Normal Sensor, NO Signal from Sensor, I _{OUT} = -100 μA	-	-	0.4	V

Logic

Watchdog Output Low Voltage	I _{WDO} = 1.0 mA	-	0.2	0.4	V
Watchdog Output High Leakage	V _{WDO} = V _{CC}	-	-	10	μA
Watchdog Input Voltage High	-	-	1.5	2.0	V
Watchdog Input Voltage Low	-	0.8	1.4	-	V
Watchdog Input Pullup Current	WD1 = WD2 = 2.0 V	-30	-	-450	μA
Watchdog Input Pullup Current	WD1 = WD2 = 0.8 V	-50	-	-600	μA
Thold Pin Input Current	0.3 V < V _{THOLD} < V _{CC}	-	5.0	40	μA
Test Input Low Threshold	-	0.3 V _{CC}	-	-	V
Test Input High Threshold	-	-	-	0.7 V _{CC}	V
Test Input Current	V _{IN} = 0.7 V _{CC} , TEST = 1	-25	-	220	μA
OLE Input Low Threshold	-	0.8	1.4	-	V
OLE Input High Threshold	-	-	1.5	2.0	V
OLE Input Current	OLE = 1.0, V _{IN} = 2.0 V	-30	-	-450	μA
OLE Input Current	OLE = Low, V _{IN} = 0.8 V	-50	-	-600	μA

NCV7001

ELECTRICAL CHARACTERISTICS (continued) (4.5 V ≤ V_{CC} ≤ 5.5 V, -40°C ≤ T_J ≤ 125°C; unless otherwise noted.)

Characteristic	Test Conditions	Min	Typ	Max	Unit
Low Voltage Reset					
Timeout Delay	V _{CC} - Increasing 0 to 5.0 V	30	50	70	ms
Reset Delay	V _{CC} - Decreasing 5.0 to 4.25 V	-	-	1.0	ms
NLVI Rise and Fall Time	10 k Pullup & CL = 30 pF	-	-	50	μs
LVI Rise and Fall Time	57 k Pulldown & CL = 30 pF	-	-	50	μs
Threshold High V _{CC} Going Up	-	-	4.66	4.75	V
Threshold Low V _{CC} Going Low	-	4.5	4.59	-	V
Threshold Hysteresis	LVTH - LVTL	30	70	-	mV
NLVI Output Low	25°C ≤ T ≤ 125°C, V _{CC} = 1.0 V, I _{NLVI} = 1.0 mA	-	150	300	mV
	-40°C ≤ T ≤ 125°C, V _{CC} = 1.2 V, I _{NLVI} = 1.0 mA	-	150	300	mV
NLVI Output Low	V _{CC} = 4.5 V @ -40°C, I _{NLVI} = 2.5 mA	-	150	300	mV
NLVI Output Leakage	V _{NLI} = V _{CC}	-10	-	10	μA
LVI Output High	V _{CC} = 1.0 V, I _{LV} = -36 μA	0.8	0.9	-	V
LVI Output High	V _{CC} = 4.5 V, I _{LV} = -250 μA	3.6	4.3	-	V
LVI Output Leakage	4.75 < V _{CC} 5.25 V, V _{LVC} = 0 V	-7.5	-	7.5	μA
Timing Specs					
Watchdog Short Time Detect	(Watchdog Running at 300 Hz)	4.56	6.075	7.59	ms
Watchdog Long Time Detect	(Watchdog Running at 33 Hz)	13.7	18.25	22.8	ms
Watchdog Skew Time Detect	(Difference between WD1 & WD2)	0.7	-	2.1	ms
Watchdog Timeout Delay Time	-	30	50	70	ms
Output Rise Time	CL = 30 pF	-	0.5	2.0	μs
Output Fall Time	CL = 30 pF	-	0.05	2.0	μs
Delay Input to Output	-	-	1.0	20	μs
OLE Delay to N _{OUT}	-	-	1.0	20	μs

NCV7001

PIN DESCRIPTION

Pin No.	Symbol	Description
1	RDLY	Determines the low voltage reset delay and watchdog enable and disable delay.
2	NTEST	Low = test, high = normal operation.
3	INN1	Minus input to channel 1 comparator.
4	INP1	Plus input to channel 1 comparator.
5	INN2	Minus input to channel 2 comparator.
6	INP2	Plus input to channel 2 comparator.
7	INP3	Plus input to channel 3 comparator.
8	INN3	Minus input to channel 3 comparator.
9	INP4	Plus input to channel 4 comparator.
10	INN4	Minus input to channel 4 comparator.
11	THOLD	Variable threshold adjustment.
12	GND	Ground.
13	NOUT4	Inverted output of comparator 4.
14	NOUT3	Inverted output of comparator 3.
15	WDLY	Determines watchdog timing.
16	OLE	Disables outputs. High = normal operation. Low = forces all outputs and comparators high.
17	WD1	Watchdog input.
18	V _{CC}	5.0 V input to IC.
19	WD2	Watchdog input.
20	NLVI	Reset output (in reset when low).
21	LVI	Reset output (in reset when high).
22	WDO	Watchdog output (low for valid watchdog signal).
23	NOUT2	Inverted output of comparator 2.
24	NOUT1	Inverted output of comparator 1.

Table 1. Wheel Speed Output Functionality

Sensor	NTEST	OLE	NOUTx
OPEN	L	L	H
OPEN	L	H	L
OPEN	H	L	H
OPEN	H	H	X
NORMAL	L	L	H
NORMAL	L	H	H
NORMAL	H	L	H
NORMAL	H	H	X

†X = Do not care (dependent on presence of sensor signal).

NCV7001

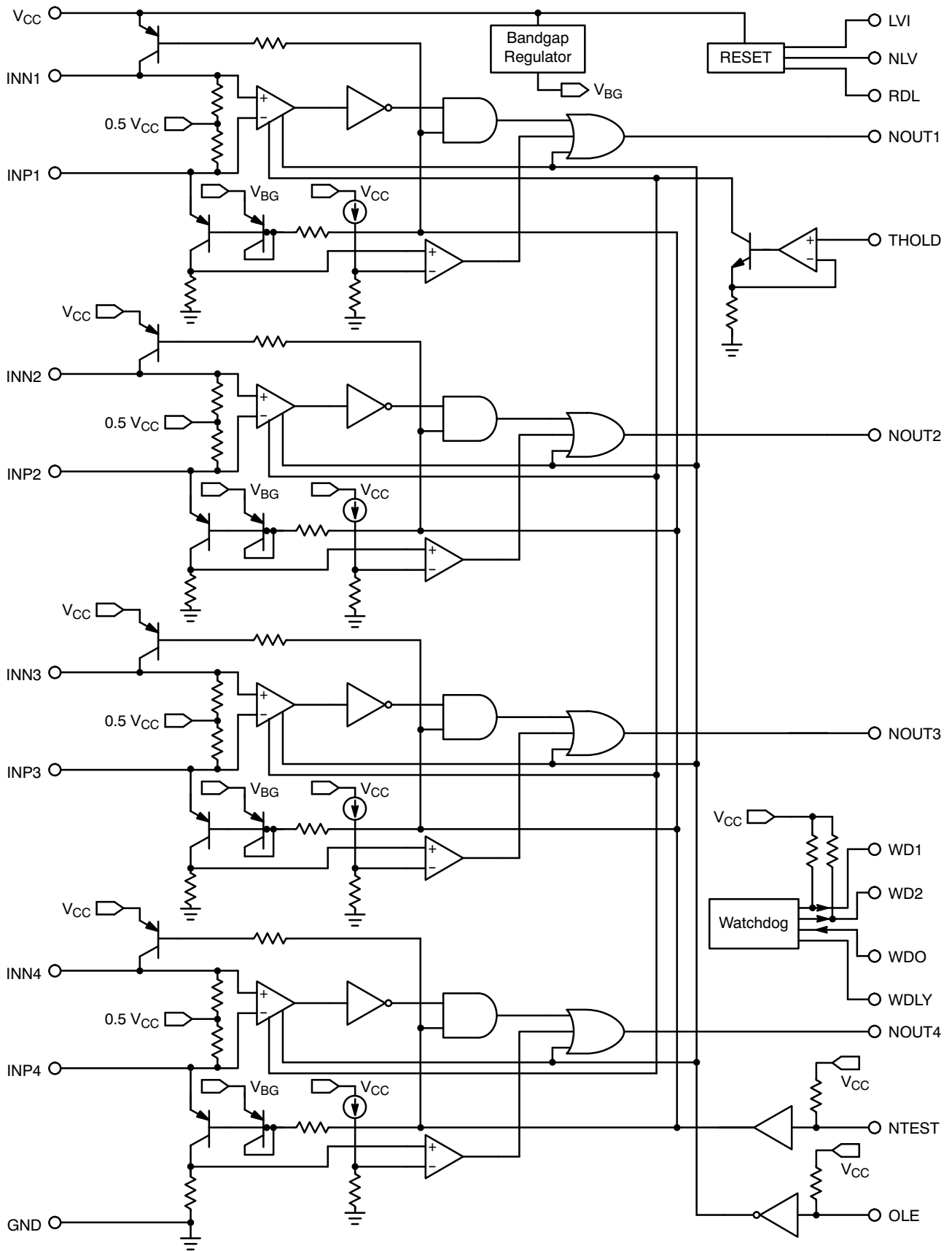
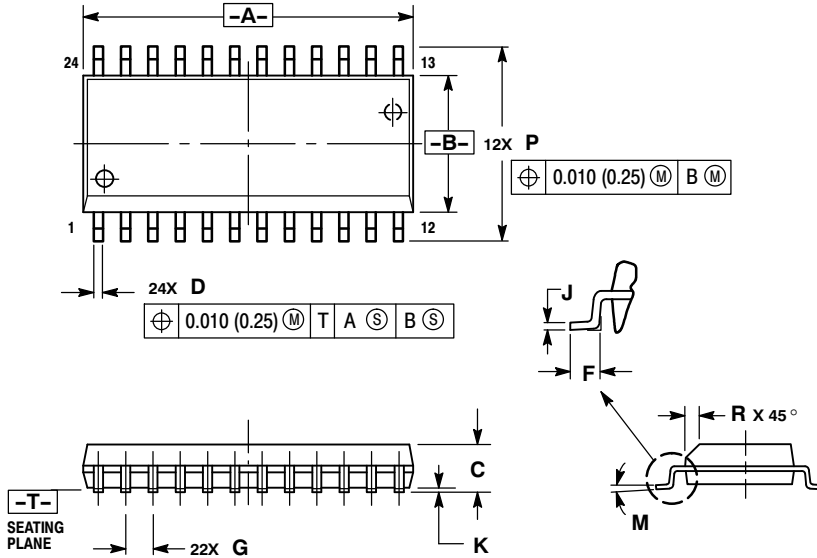


Figure 2. Block Diagram

NCV7001

PACKAGE DIMENSIONS

SO-24L
DW SUFFIX
CASE 751E-04
ISSUE E



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
 3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
 4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
 5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	15.25	15.54	0.601	0.612
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.41	0.90	0.016	0.035
G	1.27 BSC		0.050 BSC	
J	0.23	0.32	0.009	0.013
K	0.13	0.29	0.005	0.011
M	0°	8°	0°	8°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

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
Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative