NCP304A

Voltage Detector Series

The NCP304A is a second generation ultra−low current voltage detector. This device is specifically designed for use as a reset controller in portable microprocessor based systems where extended battery life is paramount.

This device features a highly accurate undervoltage detector with hysteresis which prevents erratic system reset operation as the comparator threshold is crossed.

The NCP304A consists of complementary output devices that are available with either an active high or active low reset output.
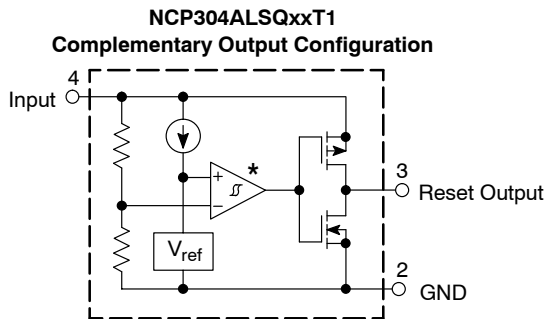
The NCP304A is available in the SC−82AB package with standard undervoltage thresholds. Additional thresholds that range from 0.9 V to 4.9 V in 100 mV steps can be manufactured.

Features
- Quiescent Current of 1.0 μA Typical
- High Accuracy Undervoltage Threshold of 2.0%
- Wide Operating Voltage Range of 0.8 V to 10 V
- Complementary Output
- Active Low or Active High Reset Output
- This is a Pb−Free Device

Typical Applications
- Microprocessor Reset Controller
- Low Battery Detection
- Power Fail Indicator
- Battery Backup Detection

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SC−82AB
SQ SUFFIX
CASE 419C

PIN CONNECTIONS AND MARKING DIAGRAM

V_{in} [4]   [3] Reset Output

SUD M ▪

NC [1]   [2] GND

(Top View)

SUD	= Specific Device Code
M	= Date Code
▪	= Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

NCP304ALSQxxT1
Complementary Output Configuration
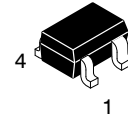

This device contains 38 active transistors.

*The representative block diagram depicts active low reset output 'L' suffix devices. The comparator input is interchanged for the active high output 'H' suffix devices.
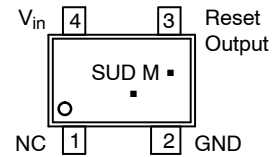
Figure 1. Representative Block Diagrams

MAXIMUM RATINGS (Note 1)

Rating	Symbol	Value	Unit
Input Power Supply Voltage (Pin 4)	V_{in}	12	V
Output Voltage (Pin 3) Complementary, NCP304A	V_{OUT}	−0.3 to V_{in}+0.3	V
Output Current (Pin 3) (Note 2)	I_{OUT}	70	mA
Thermal Resistance, Junction−to−Air	$R_{\theta JA}$	285	°C/W
Maximum Junction Temperature	T_J	+125	°C
Storage Temperature Range	T_{stg}	−55 to +150	°C
Latchup Performance (Note 3) Positive Negative	$I_{LATCHUP}$	500 170	mA

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.
1. This device series contains ESD protection and exceeds the following tests:
   Human Body Model 2000 V per MIL−STD−883, Method 3015.
   Machine Model Method 200 V.
2. The maximum package power dissipation limit must not be exceeded.

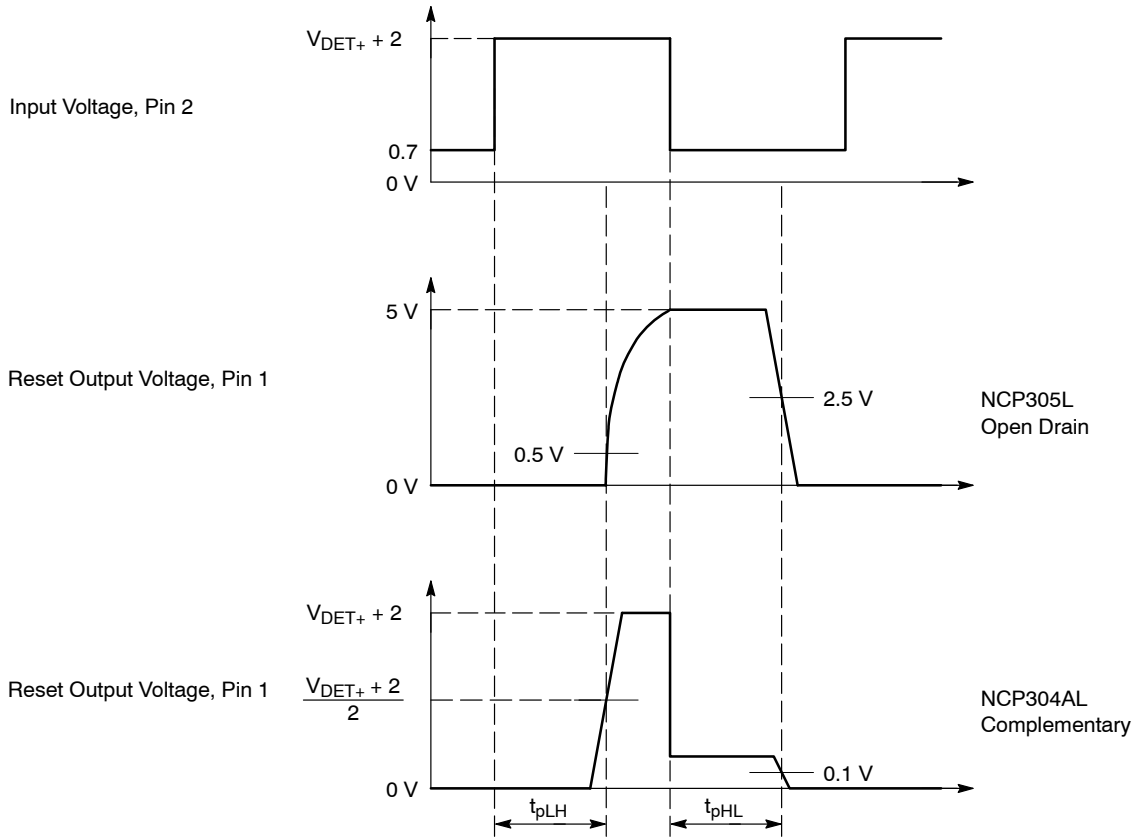$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

3. Maximum Ratings per JEDEC standard JESD78.

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
NCP304A − 4.3					
Detector Threshold (Pin 4, V_{in} Decreasing)	V_{DET-}	4.214	4.3	4.386	V
Detector Threshold Hysteresis (Pin 4, V_{in} Increasing)	V_{HYS}	0.129	0.225	0.301	V
Supply Current (Pin 4) (V_{in} = 4.14 V) (V_{in} = 6.3 V)	I_{in}	– –	– –	3.0 3.9	μA
Maximum Operating Voltage (Pin 4)	$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage (Pin 4) (T_A = −40°C to 85°C)	$V_{in(min)}$	– –	0.55 0.65	0.70 0.80	V
Reset Output Current (Pin 3, Active Low 'L' Suffix Devices) N−Channel Sink Current, NCP304A (V_{OUT} = 0.05 V, V_{in} = 0.70 V) (V_{OUT} = 0.50 V, V_{in} = 1.5 V) P−Channel Source Current, NCP304A (V_{OUT} = 5.9 V, V_{in} = 8.0 V)	I_{OUT}	 0.01 1.0 1.5	 0.05 2.0 3.0	 – – –	mA
Reset Output Current (Pin 3, Active High 'H' Suffix Devices) N−Channel Sink Current, NCP304A (V_{OUT} = 0.5 V, V_{in} = 5.0 V) P−Channel Source Current, NCP304A (V_{OUT} = 0.4 V, V_{in} = 0.7 V) (V_{OUT} = GND, V_{in} = 1.5 V)	I_{OUT}	 6.3 0.011 0.525	 11 0.04 0.6	 – – –	mA
Propagation Delay Input to Output (Figure 2) NCP304A Series Output Transition, High to Low (Note 4) Output Transition, Low to High (Note 4)	 t_{pHL} t_{pLH}	 – –	 10 21	 – 60	μs

4. The time interval between the rising edge of V_{DD} input pulse from 0.7 V to (+V_{DET}) +2.0 V and output voltage level becoming to V_{DD}/2.

Input Voltage, Pin 2

$V_{DET+} + 2$

0.7

0 V

Reset Output Voltage, Pin 1

5 V

2.5 V

NCP305L
Open Drain

0.5 V

0 V

Reset Output Voltage, Pin 1

$V_{DET+} + 2$

$\dfrac{V_{DET+} + 2}{2}$

NCP304AL
Complementary

0.1 V

0 V

t_{pLH} t_{pHL}

NCP304A is measured with a 10 pF capacitive load. The reset output voltage waveforms are shown for the active low 'L' devices. The upper detector threshold, V_{DET+} is the sum of the lower detector threshold, V_{DET-} plus the input hysteresis, V_{HYS}.

Figure 2. Propagation Delay Measurement Conditions

Table 1. NCP304A SERIES ELECTRICAL CHARACTERISTIC TABLE FOR 0.9 – 4.9 V

	Detector Threshold			Detector Threshold Hysteresis			Supply Current		N−Channel Sink Current		P−Channel Source Current
							V_{in} Low	V_{in} High	V_{in} Low	V_{in} High	
	V_{DET-} (V)			V_{HYS} (V)			I_{in} (μA) (Note 5)	I_{in} (μA) (Note 6)	I_{OUT} (mA) (Note 7)	I_{OUT} (mA) (Note 8)	I_{OUT} (mA) (Note 9)
Part Number	Min	Typ	Max	Min	Typ	Max	Typ	Typ	Typ	Typ	Typ
NCP304ALSQ43T1	4.214	4.3	4.386	0.129	0.215	0.301	1.1	1.3			3.0

5. $V_{in} = V_{DET-} − 0.16$ V
6. Condition 2: $V_{in} = V_{DET-} + 2.0$ V
7. Condition 3: $V_{in} = 0.7$ V, $V_{OUT} = 0.05$ V, Active Low 'L' Suffix Devices
8. Condition 4: $V_{in} = 1.5$ V, $V_{OUT} = 0.5$ V, Active Low 'L' Suffix Devices
9. Condition 5: $V_{in} = 8.0$ V, $V_{OUT} = 5.9$ V, Active Low 'L' Suffix Devices
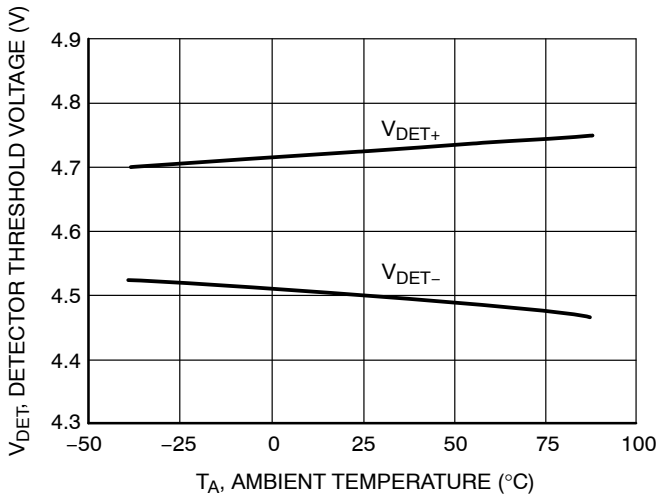
**Figure 3. NCP304A Series 4.5 V
Detector Threshold Voltage vs. Temperature**
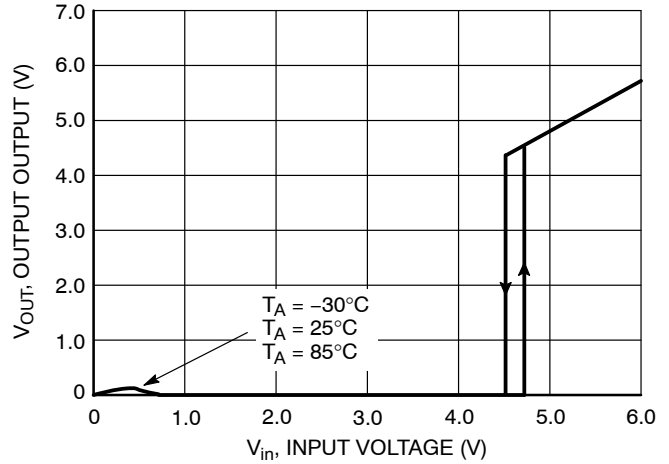
**Figure 4. NCP304AL Series 4.5 V
Reset Output Voltage vs. Input Voltage**
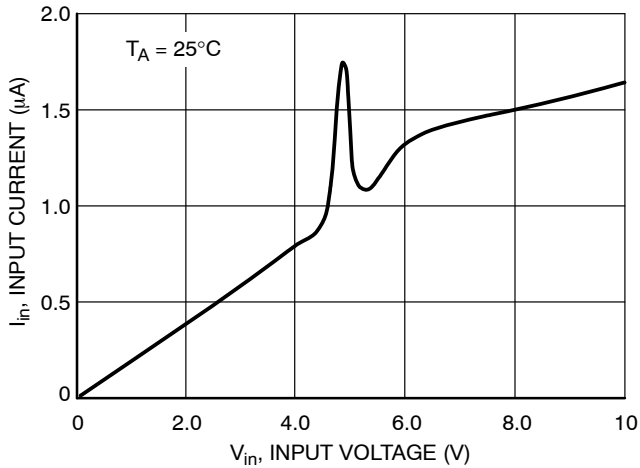
**Figure 5. NCP304A Series 4.5 V
Input Current vs. Input Voltage**
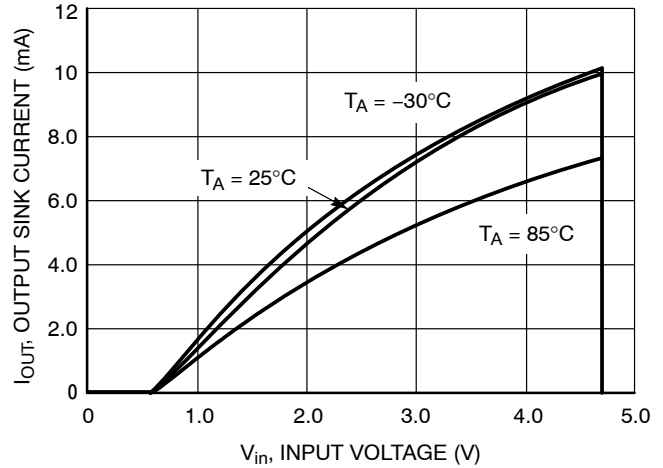
**Figure 6. NCP304AH Series 4.5 V
Reset Output Sink Current vs. Input Voltage**

OPERATING DESCRIPTION

The NCP304A is a second generation ultra−low current voltage detectors. Figures 7 and 8 show a timing diagram and a typical application. Initially consider that input voltage V_{in} is at a nominal level and it is greater than the voltage detector upper threshold (V_{DET+}), and the reset output (Pin 3) will be in the high state for active low devices, or in the low state for active high devices. If there is a power interruption and V_{in} becomes significantly deficient, it will fall below the lower detector threshold (V_{DET-}). This sequence of events causes the Reset output to be in the low state for active low devices, or in the high state for active high devices. After completion of the power interruption, V_{in} will again return to its nominal level and become greater than the V_{DET+}. The voltage detector has built−in hysteresis to prevent erratic reset operation as the comparator threshold is crossed.

Although this device is specifically designed for use as a reset controller in portable microprocessor based systems, it offers a cost−effective solution in numerous applications where precise voltage monitoring is required.

NCP304A

Input Voltage, Pin 2

Reset Output (Active Low), Pin 1

Reset Output (Active High), Pin 1
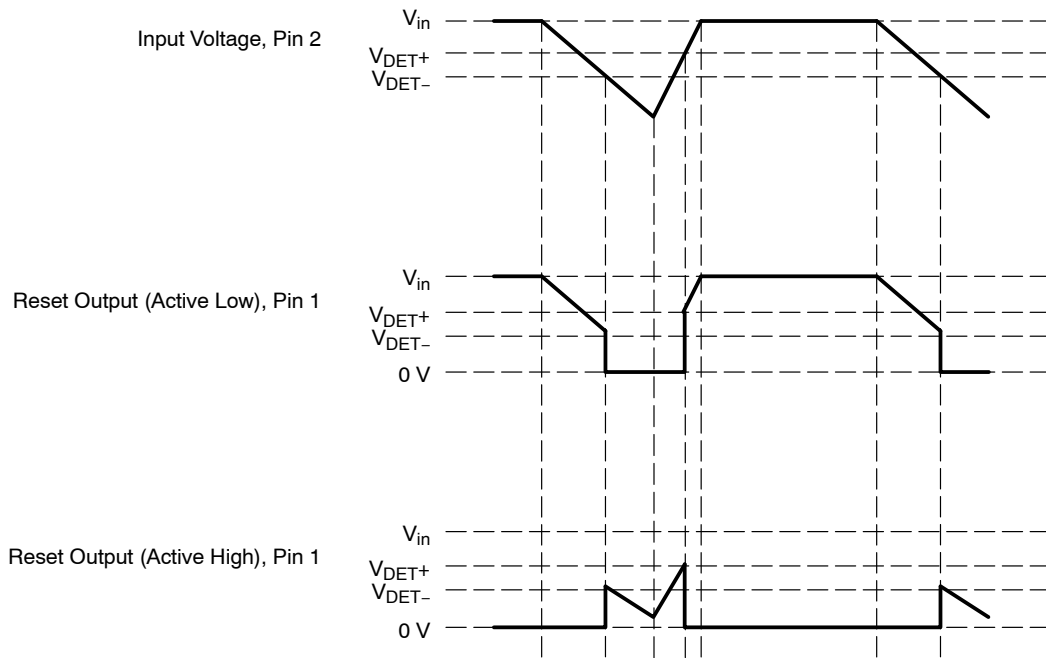
Figure 7. Timing Waveforms

APPLICATION CIRCUIT INFORMATION
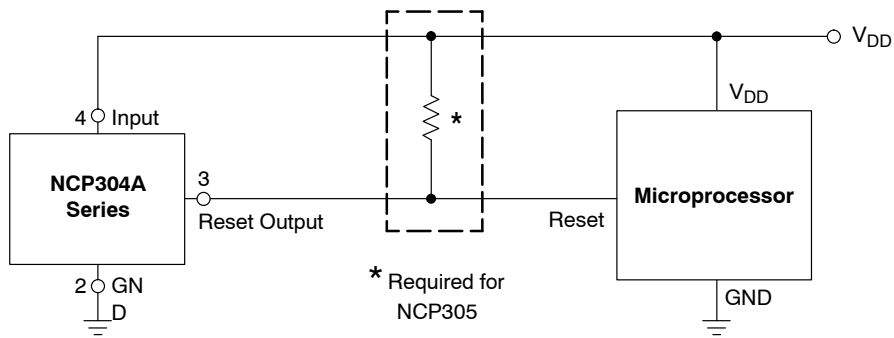
Figure 8. Microprocessor Reset Circuit

ORDERING INFORMATION

Device	Threshold Voltage	Output Type	Reset	Marking	Package	Shipping[†]
NCP304ALSQ43T1G	4.3	CMOS	Active Low	SUD	SC−82AB (Pb−Free)	3000 / Tape & Reel

NOTE: Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and NCP304A active high output devices, ranging from 0.9 V to 4.9 V in 100 mV increments can be manufactured. Contact your ON Semiconductor representative for availability.

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
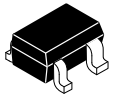
SC−82AB
CASE 419C−02
ISSUE F

DATE 22 JUN 2012

SCALE 4:1
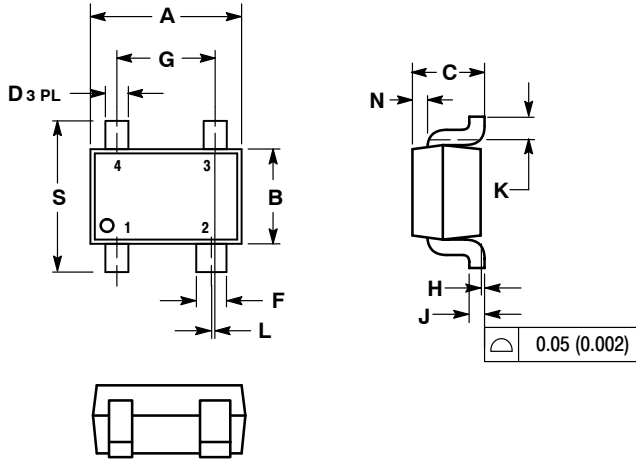
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. 419C−01 OBSOLETE. NEW STANDARD IS 419C−02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	1.80	2.20	0.071	0.087
B	1.15	1.35	0.045	0.053
C	0.80	1.10	0.031	0.043
D	0.20	0.40	0.008	0.016
F	0.30	0.50	0.012	0.020
G	1.10	1.50	0.043	0.059
H	0.00	0.10	0.000	0.004
J	0.10	0.26	0.004	0.010
K	0.10	---	0.004	---
L	0.05 BSC		0.002 BSC	
N	0.20 REF		0.008 REF	
S	1.80	2.40	0.07	0.09

⬒ 0.05 (0.002)

SOLDERING FOOTPRINT*

1.30 / 0.0512
0.65 / 0.026
1.90 / 0.075
0.95 / 0.037
0.90 / 0.035
0.70 / 0.028

SCALE 10:1 (mm / inches)
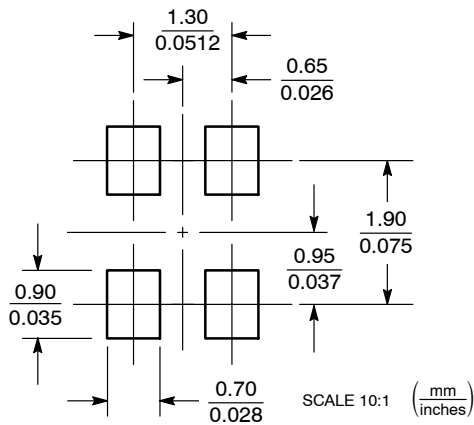
GENERIC MARKING DIAGRAM*

XXX M
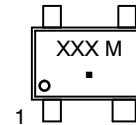
XXX = Specific Device Code
M = Month Code
▪ = Pb−Free Package

*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.

*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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ADDITIONAL INFORMATION

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