

NCP300, NCP301

Voltage Detector Series

The NCP300 and NCP301 series are second generation ultra-low current voltage detectors. These devices are specifically designed for use as reset controllers in portable microprocessor based systems where extended battery life is paramount.

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

The NCP300 series consists of complementary output devices that are available with either an active high or active low reset output. The NCP301 series has an open drain N-Channel output with either an active high or active low reset output.

The NCP300 and NCP301 device series are available in the Thin TSOP-5 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 0.5 μ A Typical
- High Accuracy Undervoltage Threshold of 2.0%
- Wide Operating Voltage Range of 0.8 V to 10 V
- Complementary or Open Drain Reset Output
- Active Low or Active High Reset Output
- Specified Over the -40°C to $+125^{\circ}\text{C}$ Temperature Range (Except for Voltage Options from 0.9 to 1.1 V)
- Pb-Free Packages are Available

Typical Applications

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



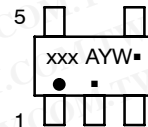
ON Semiconductor®

http://onsemi.com



THIN SOT23-5/
 TSOP-5/SC59-5
 CASE 483

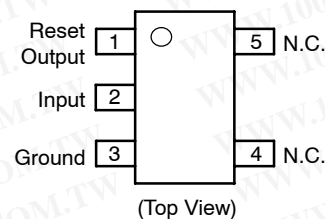
MARKING DIAGRAM



xxx = Specific Device Code
 A = Assembly Location
 Y = Year
 W = Work Week
 ■ = Pb-Free Package

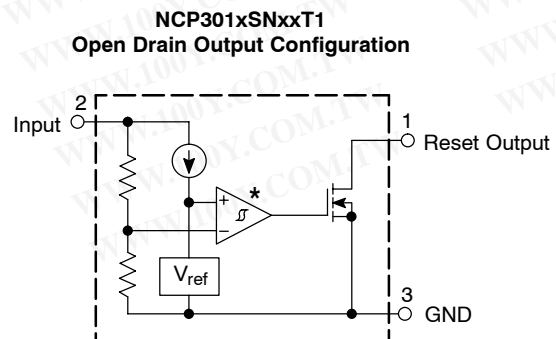
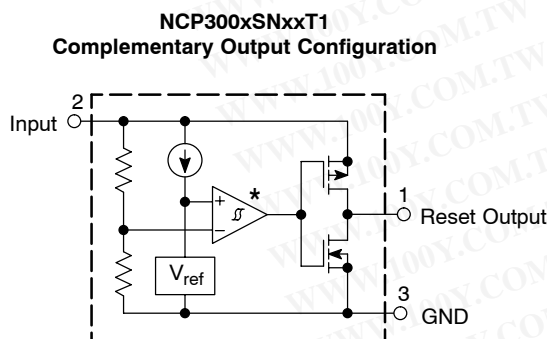
(Note: Microdot may be in either location)

PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering and shipping information in the ordering information section on page 21 of this data sheet.



* The representative block diagrams depict active low reset output 'L' suffix devices. The comparator inputs are interchanged for the active high output 'H' suffix devices.

This device contains 25 active transistors.

Figure 1. Representative Block Diagrams

NCP300, NCP301

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MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|-----------------|--------------------------------------|----------|
| Input Power Supply Voltage (Pin 2) | V_{in} | 12 | V |
| Output Voltage (Pin 1) Complementary, NCP300 N-Channel Open Drain, NCP301 | V_{OUT} | -0.3 to $V_{in} + 0.3$ -0.3 to 12 | V |
| Output Current (Pin 1) (Note 2) | I_{OUT} | 70 | mA |
| Thermal Resistance Junction-to-Air | $R_{\theta JA}$ | 250 | °C/W |
| Maximum Junction Temperature All NCP Options All NCV Options | T_J | +125 +150 | °C |
| Operating Ambient Temperature Range All Voltage Options: 0.9 V to 1.1 V All Voltage Options: 1.2 V to 4.9 V | T_A T_A | -40 to +85 -40 to +125 | °C °C |
| Storage Temperature Range | T_{stg} | -55 to +150 | °C |
| Moisture Sensitivity Level | MSL | 1 | |
| Latchup Performance (Note 3) Positive Negative | $I_{LATCHUP}$ | 200 200 | 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.

- 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.
- The maximum package power dissipation limit must not be exceeded.

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

- Maximum ratings per JEDEC standard JESD78.

NCP300, NCP301

ELECTRICAL CHARACTERISTICS (For all values $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|--|------------------------|---------------------|----------------------|---------------|
| NCP300/1 - 0.9 / NCV300/1 - 0.9 ($T_A = 25^{\circ}\text{C}$ for voltage options from 0.9 to 1.1 V) | | | | | |
| Detector Threshold (Pin 2, V_{in} Decreasing) | V_{DET-} | 0.882 | 0.900 | 0.918 | V |
| Detector Threshold Hysteresis (Pin 2, V_{in} Increasing) | V_{HYS} | 0.027 | 0.045 | 0.063 | V |
| Supply Current (Pin 2) ($V_{in} = 0.8\text{ V}$) ($V_{in} = 2.9\text{ V}$) | I_{in} | - - | 0.20 0.45 | 0.6 1.2 | μA |
| Maximum Operating Voltage (Pin 2) | $V_{in(max)}$ | - | - | 10 | V |
| Minimum Operating Voltage (Pin 2) ($T_A = -40^{\circ}\text{C}$ to 85°C) | $V_{in(min)}$ | - - | 0.55 0.65 | 0.70 0.80 | V |
| Reset Output Current (Pin 1, Active Low 'L' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.05\text{ V}$, $V_{in} = 0.70\text{ V}$) ($V_{OUT} = 0.50\text{ V}$, $V_{in} = 0.85\text{ V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 2.4\text{ V}$, $V_{in} = 4.5\text{ V}$) | I_{OUT} | 0.01 0.05 | 0.05 0.50 | - - | mA |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 1.5\text{ V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 0.8\text{ V}$) | I_{OUT} | 1.05 0.011 0.014 | 2.5 0.04 0.08 | - - - | mA |
| Propagation Delay Input to Output (Figure 2) Complementary Output NCP300 Series Output Transition, High to Low Output Transition, Low to High N-Channel Open Drain NCP301 Series Output Transition, High to Low Output Transition, Low to High | t_{pHL} t_{pLH} t_{pHL} t_{pLH} | - - - - | 97 77 97 - | - 300 - 300 | μs |
| NCP300/1 - 1.8 / NCV300/1 - 1.8 | | | | | |
| Detector Threshold (Pin 2, V_{in} Decreasing) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | V_{DET-} | 1.764 1.746 | 1.80 - | 1.836 1.854 | V |
| Detector Threshold Hysteresis (Pin 2, V_{in} Increasing) | V_{HYS} | 0.054 | 0.090 | 0.126 | V |
| Supply Current (Pin 2) ($V_{in} = 1.7\text{ V}$) ($V_{in} = 3.8\text{ V}$) | I_{in} | - - | 0.23 0.48 | 0.7 1.3 | μA |
| Maximum Operating Voltage (Pin 2) | $V_{in(max)}$ | - | - | 10 | V |
| Minimum Operating Voltage (Pin 2) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | $V_{in(min)}$ | - - | 0.55 0.65 | 0.70 0.80 | V |
| Reset Output Current (Pin 1, Active Low 'L' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.05\text{ V}$, $V_{in} = 0.70\text{ V}$) ($V_{OUT} = 0.50\text{ V}$, $V_{in} = 1.5\text{ V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 2.4\text{ V}$, $V_{in} = 4.5\text{ V}$) | I_{OUT} | 0.01 1.0 | 0.05 2.0 | - - | mA |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 5.0\text{ V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{ V}$) | I_{OUT} | 6.3 0.011 0.525 | 11 0.04 0.6 | - - - | mA |
| Propagation Delay Input to Output (Figure 2) | | | | | μs |

NCP300, NCP301

ELECTRICAL CHARACTERISTICS (continued) (For all values $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|--|-----------------------|----------------------|----------------------|---------------|
| NCP300/1 – 1.8 / NCV300/1 – 1.8 | | | | | |
| Complementary Output NCP300 Series Output Transition, High to Low | t_{pHL} | – | 73 | – | |
| Output Transition, Low to High | t_{pLH} | – | 94 | 300 | |
| N-Channel Open Drain NCP301 Series Output Transition, High to Low | t_{pHL} | – | 73 | – | |
| Output Transition, Low to High | t_{pLH} | – | – | 300 | |
| NCP300/1 – 2.0 / NCV300/1 – 2.0 | | | | | |
| Detector Threshold (Pin 2, V_{in} Decreasing) ($T_A = 25^\circ\text{C}$) ($T_A = -40^\circ\text{C}$ to 125°C) | V_{DET-} | 1.96 1.94 | 2.00 – | 2.04 2.06 | V |
| Detector Threshold Hysteresis (Pin 2, V_{in} Increasing) | V_{HYS} | 0.06 | 0.10 | 0.14 | V |
| Supply Current (Pin 2) ($V_{in} = 1.9\text{ V}$) ($V_{in} = 4.0\text{ V}$) | I_{in} | – – | 0.23 0.48 | 0.8 1.3 | μA |
| Maximum Operating Voltage (Pin 2) | $V_{in(max)}$ | – | – | 10 | V |
| Minimum Operating Voltage (Pin 2) ($T_A = 25^\circ\text{C}$) ($T_A = -40^\circ\text{C}$ to 125°C) | $V_{in(min)}$ | – – | 0.55 0.65 | 0.70 0.80 | V |
| Reset Output Current (Pin 1, Active Low 'L' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 1.5\text{V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 2.4\text{V}$, $V_{in} = 4.5\text{V}$) | I_{OUT} | 0.01 1.0 | 0.14 3.5 | – – | mA |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 5.0\text{ V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{ V}$) | I_{OUT} | 6.3 0.011 0.525 | 11 0.04 0.6 | – – – | mA |
| Propagation Delay Input to Output (Figure 2) Complementary Output NCP300 Series Output Transition, High to Low Output Transition, Low to High N-Channel Open Drain NCP301 Series Output Transition, High to Low Output Transition, Low to High | t_{pHL} t_{pLH} t_{pHL} t_{pLH} | – – – – | 55 108 55 – | – 300 – 300 | μs |
| NCP300/1 – 2.2 / NCV300/1 – 2.2 | | | | | |
| Detector Threshold (Pin 2, V_{in} Decreasing) ($T_A = 25^\circ\text{C}$) ($T_A = -40^\circ\text{C}$ to 125°C) | V_{DET-} | 2.156 2.134 | 2.2 – | 2.244 2.266 | V |
| Detector Threshold Hysteresis (Pin 2, V_{in} Increasing) | V_{HYS} | 0.066 | 0.110 | 0.154 | V |
| Supply Current (Pin 2) ($V_{in} = 2.1\text{ V}$) ($V_{in} = 4.2\text{ V}$) | I_{in} | – – | 0.23 0.48 | 0.8 1.3 | μA |
| Maximum Operating Voltage (Pin 2) | $V_{in(max)}$ | – | – | 10 | V |
| Minimum Operating Voltage (Pin 2) ($T_A = 25^\circ\text{C}$) ($T_A = -40^\circ\text{C}$ to 125°C) | $V_{in(min)}$ | – – | 0.55 0.65 | 0.70 0.80 | V |
| Reset Output Current (Pin 1, Active Low 'L' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 1.5\text{V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 2.4\text{V}$, $V_{in} = 4.5\text{V}$) | I_{OUT} | 0.01 1.0 | 0.14 3.5 | – – | mA |
| | | 1.0 | 9.7 | – | |

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NCP300, NCP301

ELECTRICAL CHARACTERISTICS (continued) (For all values $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---------------|----------------|--------------|----------------|---------------|
| NCP300/1 – 2.2 / NCV300/1 – 2.2 | | | | | |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) | I_{OUT} | | | | mA |
| N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 5.0\text{ V}$) | | 6.3 | 11 | – | |
| P-Channel Source Current, NCP300 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{ V}$) | | 0.011 0.525 | 0.04 0.6 | – – | |
| Propagation Delay Input to Output (Figure 2) | | | | | μs |
| Complementary Output NCP300 Series | | | | | |
| Output Transition, High to Low | t_{pHL} | – | 55 | – | |
| Output Transition, Low to High | t_{pLH} | – | 108 | 300 | |
| N-Channel Open Drain NCP301 Series | | | | | |
| Output Transition, High to Low | t_{pHL} | – | 55 | – | |
| Output Transition, Low to High | t_{pLH} | – | – | 300 | |
| NCP300/1– 2.7 / NCV300/1– 2.7 | | | | | |
| Detector Threshold (Pin 2, V_{in} Decreasing) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | V_{DET-} | 2.646 2.619 | 2.700 – | 2.754 2.781 | V |
| Detector Threshold Hysteresis (Pin 2, V_{in} Increasing) | V_{HYS} | 0.081 | 0.135 | 0.189 | V |
| Supply Current (Pin 2) ($V_{in} = 2.6\text{ V}$) ($V_{in} = 4.7\text{ V}$) | I_{in} | – – | 0.25 0.50 | 0.8 1.3 | μA |
| Maximum Operating Voltage (Pin 2) | $V_{in(max)}$ | – | – | 10 | V |
| Minimum Operating Voltage (Pin 2) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | $V_{in(min)}$ | – – | 0.55 0.65 | 0.70 0.80 | V |
| Reset Output Current (Pin 1, Active Low 'L' Suffix Devices) | I_{OUT} | | | | mA |
| N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 1.5\text{V}$) | | 0.01 1.0 | 0.14 3.5 | – – | |
| P-Channel Source Current, NCP300 ($V_{OUT} = 2.4\text{V}$, $V_{in} = 4.5\text{V}$) | | 1.0 | 9.7 | – | |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) | I_{OUT} | | | | mA |
| N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 5.0\text{ V}$) | | 6.3 | 11 | – | |
| P-Channel Source Current, NCP300 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{ V}$) | | 0.011 0.525 | 0.04 0.6 | – – | |
| Propagation Delay Input to Output (Figure 2) | | | | | μs |
| Complementary Output NCP300 Series | | | | | |
| Output Transition, High to Low | t_{pHL} | – | 55 | – | |
| Output Transition, Low to High | t_{pLH} | – | 115 | 300 | |
| N-Channel Open Drain NCP301 Series | | | | | |
| Output Transition, High to Low | t_{pHL} | – | 55 | – | |
| Output Transition, Low to High | t_{pLH} | – | – | 300 | |
| NCP300/1– 2.8 / NCV300/1– 2.8 | | | | | |
| Detector Threshold (Pin 2, V_{in} Decreasing) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | V_{DET-} | 2.744 2.716 | 2.8 – | 2.856 2.884 | V |
| Detector Threshold Hysteresis (Pin 2, V_{in} Increasing) | V_{HYS} | 0.084 | 0.14 | 0.196 | V |
| Supply Current (Pin 2) ($V_{in} = 2.7\text{ V}$) ($V_{in} = 4.8\text{ V}$) | I_{in} | – – | 0.25 0.5 | 0.8 1.3 | μA |
| Maximum Operating Voltage (Pin 2) | $V_{in(max)}$ | – | – | 10 | V |

NCP300, NCP301

ELECTRICAL CHARACTERISTICS (continued) (For all values $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|--|---------------------------|--------------------------|--------------------------|---------------|
| NCP300/1 – 2.8 / NCV300/1 – 2.8 | | | | | |
| Minimum Operating Voltage (Pin 2) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | $V_{in(min)}$ | – – | 0.55 0.65 | 0.7 0.8 | V |
| Reset Output Current (Pin 1, Active Low 'L' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 1.5\text{V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 2.4\text{V}$, $V_{in} = 4.5\text{V}$) | I_{OUT} | 0.01 1.0 1.0 | 0.14 3.5 9.7 | – – – | mA |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.5\text{V}$, $V_{in} = 5.0\text{V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 0.4\text{V}$, $V_{in} = 0.7\text{V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{V}$) | I_{OUT} | 6.3 0.011 0.525 | 11 0.04 0.6 | – – – | mA |
| Propagation Delay Input to Output (Figure 2) Complementary Output NCP300 Series Output Transition, High to Low Output Transition, Low to High N-Channel Open Drain NCP301 Series Output Transition, High to Low Output Transition, Low to High | t_{pHL} t_{pLH} t_{pHL} t_{pLH} | – – – – | 55 115 55 – | – 300 – 300 | μs |

NCP300/1 – 3.0 / NCV300/1 – 3.0

| | | | | | |
|--|--|---------------------------|--------------------------|--------------------------|---------------|
| Detector Threshold (Pin 2, V_{in} Decreasing) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | V_{DET-} | 2.94 2.91 | 3.00 – | 3.06 3.09 | V |
| Detector Threshold Hysteresis (Pin 2, V_{in} Increasing) | V_{HYS} | 0.09 | 0.15 | 0.21 | V |
| Supply Current (Pin 2) ($V_{in} = 2.87\text{V}$) ($V_{in} = 5.0\text{V}$) | I_{in} | – – | 0.25 0.50 | 0.9 1.3 | μA |
| Maximum Operating Voltage (Pin 2) | $V_{in(max)}$ | – | – | 10 | V |
| Minimum Operating Voltage (Pin 2) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | $V_{in(min)}$ | – – | 0.55 0.65 | 0.70 0.80 | V |
| Reset Output Current (Pin 1, Active Low 'L' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 1.5\text{V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 2.4\text{V}$, $V_{in} = 4.5\text{V}$) | I_{OUT} | 0.01 1.0 1.0 | 0.14 3.5 9.7 | – – – | mA |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.5\text{V}$, $V_{in} = 5.0\text{V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 0.4\text{V}$, $V_{in} = 0.7\text{V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{V}$) | I_{OUT} | 6.3 0.011 0.525 | 11 0.04 0.6 | – – – | mA |
| Propagation Delay Input to Output (Figure 2) Complementary Output NCP300 Series Output Transition, High to Low Output Transition, Low to High N-Channel Open Drain NCP301 Series Output Transition, High to Low Output Transition, Low to High | t_{pHL} t_{pLH} t_{pHL} t_{pLH} | – – – – | 49 115 49 – | – 300 – 300 | μs |

NCP300/1 – 4.5 / NCV300/1 – 4.5

NCP300, NCP301

ELECTRICAL CHARACTERISTICS (continued) (For all values $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|--|-----------------------|----------------------|----------------------|---------------|
| NCP300/1 – 4.5 / NCV300/1 – 4.5 | | | | | |
| Detector Threshold (Pin 2, V_{in} Decreasing) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | V_{DET-} | 4.410 4.365 | 4.500 – | 4.590 4.635 | V |
| Detector Threshold Hysteresis (Pin 2, V_{in} Increasing) | V_{HYS} | 0.135 | 0.225 | 0.315 | V |
| Supply Current (Pin 2) ($V_{in} = 4.34\text{ V}$) ($V_{in} = 6.5\text{ V}$) | I_{in} | – – | 0.33 0.52 | 1.0 1.4 | μA |
| Maximum Operating Voltage (Pin 2) | $V_{in(max)}$ | – | – | 10 | V |
| Minimum Operating Voltage (Pin 2) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | $V_{in(min)}$ | – – | 0.55 0.65 | 0.70 0.80 | V |
| Reset Output Current (Pin 1, Active Low 'L' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 1.5\text{V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 5.9\text{V}$, $V_{in} = 8.0\text{V}$) | I_{OUT} | 0.01 1.0 1.5 | 0.05 2.0 10.5 | – – – | mA |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 5.0\text{ V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{ V}$) | I_{OUT} | 6.3 0.011 0.525 | 11 0.04 0.6 | – – – | mA |
| Propagation Delay Input to Output (Figure 2) Complementary Output NCP300 Series Output Transition, High to Low Output Transition, Low to High N-Channel Open Drain NCP301 Series Output Transition, High to Low Output Transition, Low to High | t_{pHL} t_{pLH} t_{pHL} t_{pLH} | – – – – | 49 130 49 – | – 300 – 300 | μs |
| NCP300/1 – 4.7 / NCV300/1 – 4.7 | | | | | |
| Detector Threshold (Pin 2, V_{in} Decreasing) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | V_{DET-} | 4.606 4.559 | 4.700 – | 4.794 4.841 | V |
| Detector Threshold Hysteresis (Pin 2, V_{in} Increasing) | V_{HYS} | 0.141 | 0.235 | 0.329 | V |
| Supply Current (Pin 2) ($V_{in} = 4.54\text{ V}$) ($V_{in} = 6.7\text{ V}$) | I_{in} | – – | 0.34 0.53 | 1.0 1.4 | μA |
| Maximum Operating Voltage (Pin 2) | $V_{in(max)}$ | – | – | 10 | V |
| Minimum Operating Voltage (Pin 2) ($T_A = 25^{\circ}\text{C}$) ($T_A = -40^{\circ}\text{C}$ to 125°C) | $V_{in(min)}$ | – – | 0.55 0.65 | 0.70 0.80 | V |
| Reset Output Current (Pin 1, Active Low 'L' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 1.5\text{V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 5.9\text{V}$, $V_{in} = 8.0\text{V}$) | I_{OUT} | 0.01 1.0 1.5 | 0.05 2.0 10.5 | – – – | mA |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) N-Channel Sink Current, NCP300, NCP301 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 5.0\text{ V}$) P-Channel Source Current, NCP300 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{ V}$) | I_{OUT} | 6.3 0.011 0.525 | 11 0.04 0.6 | – – – | mA |

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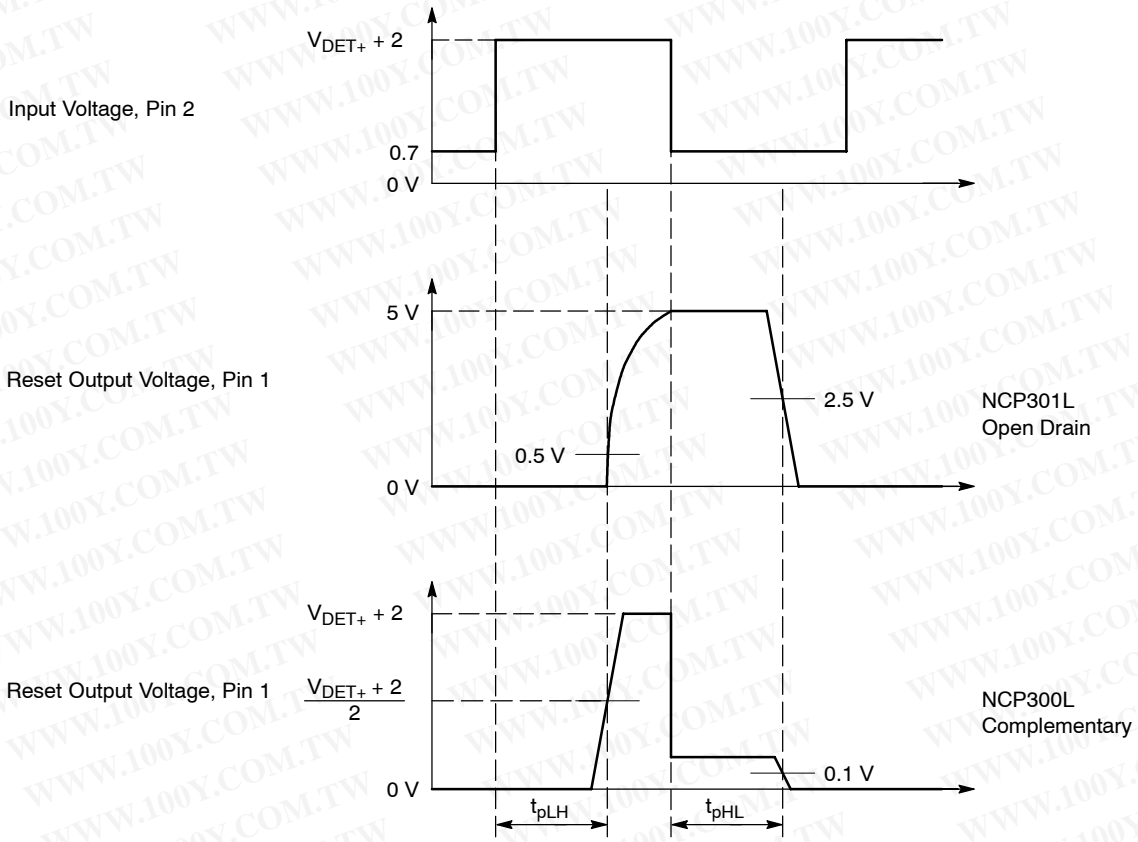
NCP300, NCP301

ELECTRICAL CHARACTERISTICS (continued) (For all values $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|-----------|-----|-----|-----|---------------|
| NCP300/1 – 4.7 / NCV300/1 – 4.7 | | | | | |
| Propagation Delay Input to Output (Figure 2) | | | | | |
| Complementary Output NCP300 Series | | | | | |
| Output Transition, High to Low | t_{pHL} | – | 45 | – | μs |
| Output Transition, Low to High | t_{pLH} | – | 130 | 300 | |
| N-Channel Open Drain NCP301 Series | | | | | |
| Output Transition, High to Low | t_{pHL} | – | 45 | – | |
| Output Transition, Low to High | t_{pLH} | – | – | 300 | |

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NCP300, NCP301



NCP300 and NCP301 series are measured with a 10 pF capacitive load. NCP301 has an additional 470 k pull-up resistor connected from the reset output to +5.0 V. 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

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NCP300, NCP301

Table 1. ELECTRICAL CHARACTERISTIC TABLE FOR 0.9 – 4.9 V

| NCP300 Series | Detector Threshold | | | Detector Threshold Hysteresis | | | Supply Current | | Nch Sink Current | | Pch Source Current |
|----------------|--------------------------------|------|-------|-------------------------------|-------|-------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|--------------------------------|
| | | | | | | | V _{in} Low | V _{in} High | V _{in} Low | V _{in} High | |
| Part Number | V _{DET-} (V) (Note 4) | | | 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) |
| | Min | Typ | Max | Min | Typ | Max | Typ | Typ | Typ | Typ | Typ |
| NCP300LSN09T1 | 0.882 | 0.9 | 0.918 | 0.027 | 0.045 | 0.063 | 0.20 | 0.45 | 0.05 | 0.5 | 2.0 |
| NCP300LSN18T1 | 1.764 | 1.8 | 1.836 | 0.054 | 0.090 | 0.126 | 0.23 | 0.48 | | | |
| NCP300LSN185T1 | 1.813 | 1.85 | 1.887 | 0.056 | 0.093 | 0.130 | | | | | |
| NCP300LSN20T1 | 1.960 | 2.0 | 2.040 | 0.060 | 0.100 | 0.140 | | | | | |
| NCP300LSN27T1 | 2.646 | 2.7 | 2.754 | 0.081 | 0.135 | 0.189 | | | | | |
| NCP300LSN28T1 | 2.744 | 2.8 | 2.856 | 0.084 | 0.140 | 0.196 | 0.25 | 0.50 | | | |
| NCP300LSN30T1 | 2.940 | 3.0 | 3.060 | 0.090 | 0.150 | 0.210 | | | | | |
| NCP300LSN33T1 | 3.234 | 3.3 | 3.366 | 0.099 | 0.165 | 0.231 | | | | | |
| NCP300LSN34T1 | 3.332 | 3.4 | 3.468 | 0.102 | 0.170 | 0.238 | | | | | |
| NCP300LSN44T1 | 4.312 | 4.4 | 4.488 | 0.132 | 0.220 | 0.308 | | | | | |
| NCP300LSN45T1 | 4.410 | 4.5 | 4.590 | 0.135 | 0.225 | 0.315 | 0.33 | 0.52 | | | |
| NCP300LSN46T1 | 4.508 | 4.6 | 4.692 | 0.138 | 0.230 | 0.322 | | | | | |
| NCP300LSN47T1 | 4.606 | 4.7 | 4.794 | 0.141 | 0.235 | 0.329 | 0.34 | 0.53 | | | |

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4. Values shown apply at +25°C only. For voltage options greater than 1.1 V, V_{DET-} limits over operating temperature range (-40°C to +125°C) are V_{NOM} ±3%. For voltage options < 1.2 V, V_{DET-} is guaranteed only at +25°C.
5. Condition 1: 0.9 – 2.9 V, V_{in} = V_{DET-} – 0.10 V; 3.0 – 3.9 V, V_{in} = V_{DET-} – 0.13 V; 4.0 – 4.9 V, V_{in} = V_{DET-} – 0.16 V
6. Condition 2: 0.9 – 4.9 V, V_{in} = V_{DET-} + 2.0 V
7. Condition 3: 0.9 – 4.9 V, V_{in} = 0.7 V, V_{OUT} = 0.05 V, Active Low 'L' Suffix Devices
8. Condition 4: 0.9 – 1.0 V, V_{in} = 0.85 V, V_{OUT} = 0.5 V; 1.1 – 1.5 V, V_{in} = 1.0 V, V_{OUT} = 0.5 V; 1.6 – 4.9 V, V_{in} = 1.5 V, V_{OUT} = 0.5 V, Active Low 'L' Suffix Devices
9. Condition 5: 0.9 – 3.9 V, V_{in} = 4.5 V, V_{OUT} = 2.4 V; 4.0 – 4.9 V, V_{in} = 8.0 V, V_{OUT} = 5.9 V, Active Low 'L' Suffix Devices

Table 2. ELECTRICAL CHARACTERISTIC TABLE FOR 0.9 – 4.9 V

| NCP300 Series | Detector Threshold | | | Detector Threshold Hysteresis | | | Supply Current | | Nch Sink Current | Pch Source Current | |
|---------------|---------------------------------|-----|-------|-------------------------------|-------|-------|--------------------------------|--------------------------------|---------------------------------|---------------------------------|---------------------------------|
| | | | | | | | V _{in} Low | V _{in} High | | V _{in} Low | V _{in} High |
| Part Number | V _{DET-} (V) (Note 10) | | | V _{HYS} (V) | | | I _{in} (μA) (Note 11) | I _{in} (μA) (Note 12) | I _{OUT} (mA) (Note 13) | I _{OUT} (mA) (Note 14) | I _{OUT} (mA) (Note 15) |
| | Min | Typ | Max | Min | Typ | Max | Typ | Typ | Typ | Typ | Typ |
| NCP300HSN09T1 | 0.882 | 0.9 | 0.918 | 0.027 | 0.045 | 0.063 | 0.20 | 0.45 | 2.5 | 0.04 | 0.08 |
| NCP300HSN18T1 | 1.764 | 1.8 | 1.836 | 0.054 | 0.090 | 0.126 | 0.23 | 0.48 | | | |
| NCP300HSN27T1 | 2.646 | 2.7 | 2.754 | 0.081 | 0.135 | 0.189 | 0.25 | 0.50 | | | |
| NCP300HSN30T1 | 2.940 | 3.0 | 3.060 | 0.090 | 0.150 | 0.210 | | | | | |
| NCP300HSN45T1 | 4.410 | 4.5 | 4.590 | 0.135 | 0.225 | 0.315 | 0.33 | 0.52 | | | |
| NCP300HSN47T1 | 4.606 | 4.7 | 4.794 | 0.141 | 0.235 | 0.329 | 0.34 | 0.53 | | | |

10. Values shown apply at +25°C only. For voltage options greater than 1.1 V, V_{DET-} limits over operating temperature range (-40°C to +125°C) are V_{NOM} ±3%. For voltage options < 1.2 V, V_{DET-} is guaranteed only at +25°C.
11. Condition 1: 0.9 – 2.9 V, V_{in} = V_{DET-} – 0.10 V; 3.0 – 3.9 V, V_{in} = V_{DET-} – 0.13 V; 4.0 – 4.9 V, V_{in} = V_{DET-} – 0.16 V
12. Condition 2: 0.9 – 4.9 V, V_{in} = V_{DET-} + 2.0 V
13. Condition 3: 0.9 – 1.4 V, V_{in} = 1.5 V, V_{OUT} = 0.5 V; 1.5 – 4.9 V, V_{in} = 5.0 V, V_{OUT} = 0.5 V, Active High 'H' Suffix Devices
14. Condition 4: 0.9 – 4.9 V, V_{in} = 0.7 V, V_{OUT} = 0.4 V, Active High 'H' Suffix Devices
15. Condition 5: 0.9 – 1.0 V, V_{in} = 0.8 V, V_{OUT} = GND; 1.1 – 1.5 V, V_{in} = 1.0 V, V_{OUT} = GND; 1.6 – 4.9 V, V_{in} = 1.5 V, V_{OUT} = GND, Active High 'H' Suffix Devices

NCP300, NCP301

Table 3. ELECTRICAL CHARACTERISTIC TABLE FOR 0.9 – 4.9 V

| NCP301 Series | Detector Threshold | | | Detector Threshold Hysteresis | | | Supply Current | | Nch Sink Current | |
|---------------|---------------------------------|-----|-------|-------------------------------|-------|-------|--------------------------------|--------------------------------|---------------------------------|---------------------------------|
| | | | | | | | V _{in} Low | V _{in} High | V _{in} Low | V _{in} High |
| | V _{DET-} (V) (Note 16) | | | V _{HYS} (V) | | | I _{in} (μA) (Note 16) | I _{in} (μA) (Note 18) | I _{OUT} (mA) (Note 19) | I _{OUT} (mA) (Note 20) |
| Part Number | Min | Typ | Max | Min | Typ | Max | Typ | Typ | Typ | Typ |
| NCP301LSN09T1 | 0.882 | 0.9 | 0.918 | 0.027 | 0.045 | 0.063 | 0.20 | 0.45 | 0.05 | 0.5 |
| NCP301LSN12T1 | 1.176 | 1.2 | 1.224 | 0.036 | 0.060 | 0.084 | | | | |
| NCP301LSN16T1 | 1.568 | 1.6 | 1.632 | 0.048 | 0.080 | 0.112 | | | | |
| NCP301LSN18T1 | 1.764 | 1.8 | 1.836 | 0.054 | 0.090 | 0.126 | | | | |
| NCP301LSN20T1 | 1.960 | 2.0 | 2.040 | 0.060 | 0.100 | 0.140 | | | | |
| NCP301LSN22T1 | 2.156 | 2.2 | 2.244 | 0.066 | 0.110 | 0.154 | | | | |
| NCP301LSN25T1 | 2.450 | 2.5 | 2.550 | 0.075 | 0.125 | 0.175 | | | | |
| NCP301LSN26T1 | 2.548 | 2.6 | 2.652 | 0.078 | 0.130 | 0.182 | 0.23 | 0.48 | | 2.0 |
| NCP301LSN27T1 | 2.646 | 2.7 | 2.754 | 0.081 | 0.135 | 0.189 | | | | |
| NCP301LSN28T1 | 2.744 | 2.8 | 2.856 | 0.084 | 0.140 | 0.196 | | | | |
| NCP301LSN30T1 | 2.940 | 3.0 | 3.060 | 0.090 | 0.150 | 0.210 | | | | |
| NCP301LSN31T1 | 3.038 | 3.1 | 3.162 | 0.093 | 0.155 | 0.217 | | | | |
| NCP301LSN32T1 | 3.136 | 3.2 | 3.264 | 0.096 | 0.160 | 0.224 | | | | |
| NCP301LSN33T1 | 3.234 | 3.3 | 3.366 | 0.099 | 0.165 | 0.231 | | | | |
| NCP301LSN34T1 | 3.332 | 3.4 | 3.468 | 0.102 | 0.170 | 0.238 | 0.25 | 0.50 | | |
| NCP301LSN40T1 | 3.920 | 4.0 | 4.080 | 0.120 | 0.200 | 0.280 | | | | |
| NCP301LSN42T1 | 4.116 | 4.2 | 4.284 | 0.126 | 0.210 | 0.294 | | | | |
| NCP301LSN45T1 | 4.410 | 4.5 | 4.590 | 0.135 | 0.225 | 0.315 | | | | |
| NCP301LSN46T1 | 4.508 | 4.6 | 4.692 | 0.138 | 0.230 | 0.322 | | | | |
| NCP301LSN47T1 | 4.606 | 4.7 | 4.794 | 0.141 | 0.235 | 0.329 | | | | |
| | | | | | | | | | | |
| | | | | | | | 0.34 | 0.53 | | |

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16. Values shown apply at +25°C only. For voltage options greater than 1.1 V, V_{DET-} limits over operating temperature range (-40°C to +125°C) are V_{NOM} ±3%. For voltage options < 1.2 V, V_{DET-} is guaranteed only at +25°C.

17. Condition 1: 0.9 – 2.9 V, V_{in} = V_{DET-} – 0.10 V; 3.0 – 3.9 V, V_{in} = V_{DET-} – 0.13 V; 4.0 – 4.9 V, V_{in} = V_{DET-} – 0.16 V

18. Condition 2: 0.9 – 4.9 V, V_{in} = V_{DET-} + 2.0 V

19. Condition 3: 0.9 – 4.9 V, V_{in} = 0.7 V, V_{OUT} = 0.05 V, Active Low 'L' Suffix Devices

20. Condition 4: 0.9 – 1.0 V, V_{in} = 0.85 V, V_{OUT} = 0.5 V; 1.1 – 1.5 V, V_{in} = 1.0 V, V_{OUT} = 0.5 V; 1.6 – 4.9 V, V_{in} = 1.5 V, V_{OUT} = 0.5 V, Active Low 'L' Suffix Devices

Table 4. ELECTRICAL CHARACTERISTIC TABLE FOR 0.9 – 4.9 V

| NCP301 Series | Detector Threshold | | | Detector Threshold Hysteresis | | | Supply Current | | Nch Sink Current |
|---------------|---------------------------------|-----|-------|-------------------------------|-------|-------|--------------------------------|--------------------------------|---------------------------------|
| | | | | | | | V _{in} Low | V _{in} High | |
| | V _{DET-} (V) (Note 21) | | | V _{HYS} (V) | | | I _{in} (μA) (Note 22) | I _{in} (μA) (Note 23) | I _{OUT} (mA) (Note 24) |
| Part Number | Min | Typ | Max | Min | Typ | Max | Typ | Typ | Typ |
| NCP301HSN09T1 | 0.882 | 0.9 | 0.918 | 0.027 | 0.045 | 0.063 | 0.20 | 0.45 | 2.5 |
| NCP301HSN18T1 | 1.764 | 1.8 | 1.836 | 0.054 | 0.090 | 0.126 | | | |
| NCP301HSN22T1 | 2.156 | 2.2 | 2.244 | 0.066 | 0.110 | 0.154 | | | |
| NCP301HSN27T1 | 2.646 | 2.7 | 2.754 | 0.081 | 0.135 | 0.189 | 0.25 | 0.50 | |
| NCP301HSN30T1 | 2.940 | 3.0 | 3.060 | 0.090 | 0.150 | 0.210 | | | |
| NCP301HSN45T1 | 4.410 | 4.5 | 4.590 | 0.135 | 0.225 | 0.315 | | | |
| | | | | | | | 0.33 | 0.52 | |

21. Values shown apply at +25°C only. For voltage options greater than 1.1 V, V_{DET-} limits over operating temperature range (-40°C to +125°C) are V_{NOM} ±3%. For voltage options < 1.2 V, V_{DET-} is guaranteed only at +25°C.

22. Condition 1: 0.9 – 2.9 V, V_{in} = V_{DET-} – 0.10 V; 3.0 – 3.9 V, V_{in} = V_{DET-} – 0.13 V; 4.0 – 4.9 V, V_{in} = V_{DET-} – 0.16 V

23. Condition 2: 0.9 – 4.9 V, V_{in} = V_{DET-} + 2.0 V

24. Condition 3: 0.9 – 1.4 V, V_{in} = 1.5 V, V_{OUT} = 0.5 V; 1.5 – 4.9 V, V_{in} = 5.0 V, V_{OUT} = 0.5 V, Active High 'H' Suffix Devices

NCP300, NCP301

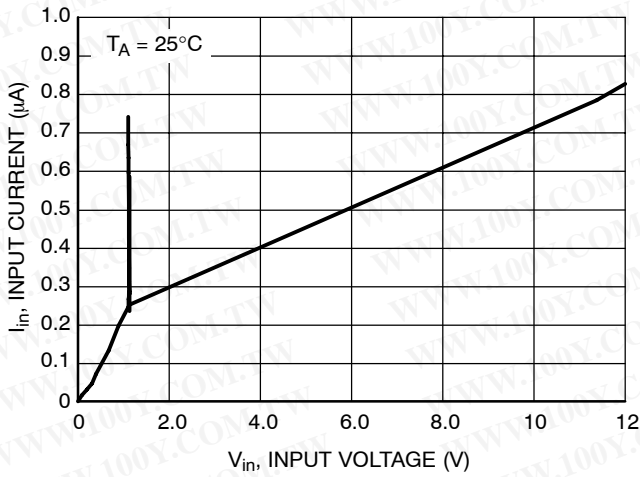


Figure 3. NCP300/1 Series 0.9 V Input Current versus Input Voltage

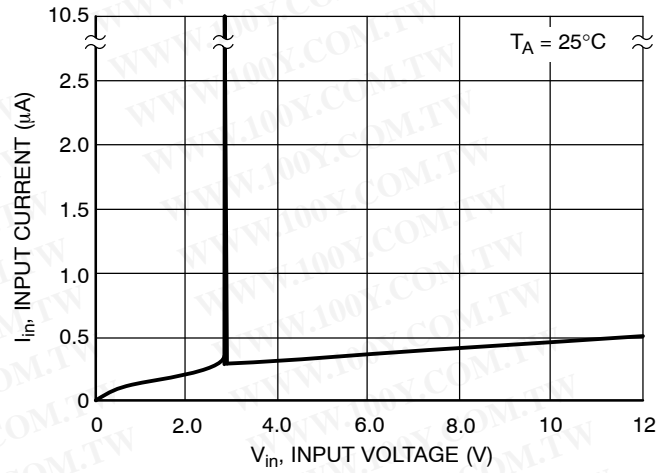


Figure 4. NCP300/1 Series 2.7 V Input Current versus Input Voltage

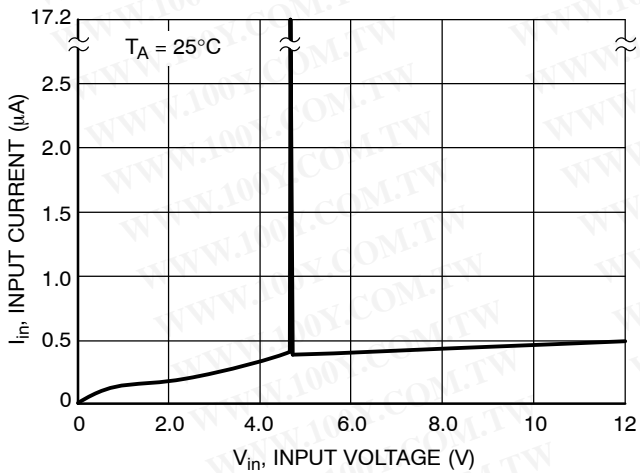


Figure 5. NCP300/1 Series 4.5 V Input Current versus Input Voltage

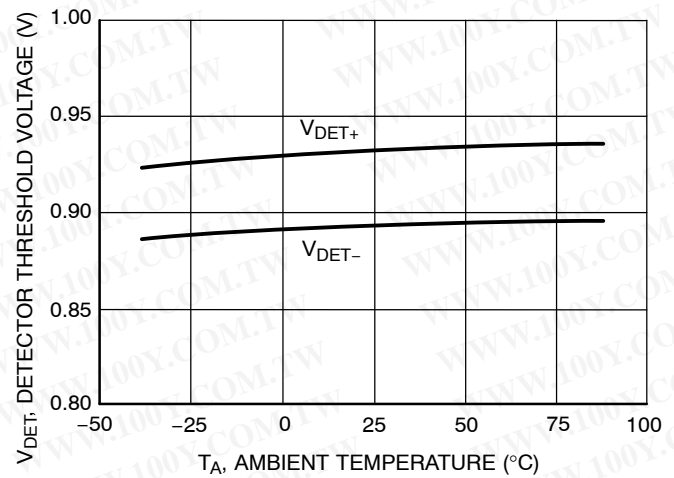


Figure 6. NCP300/1 Series 0.9 V Detector Threshold Voltage versus Temperature

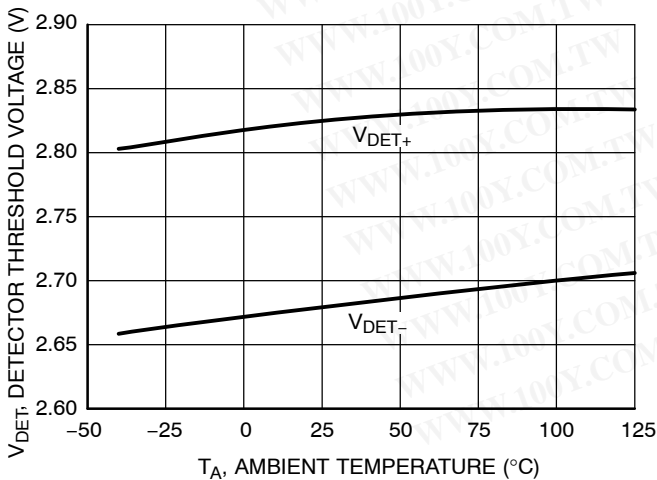


Figure 7. NCP300/1 Series 2.7 V Detector Threshold Voltage versus Temperature

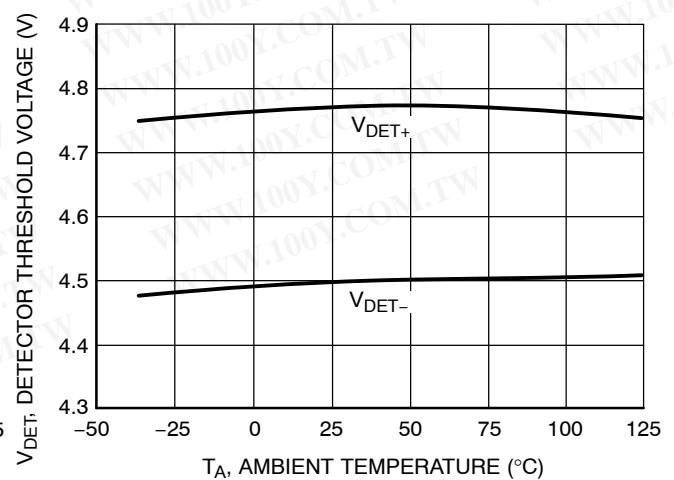


Figure 8. NCP300/1 Series 4.5 V Detector Threshold Voltage versus Temperature

NCP300, NCP301

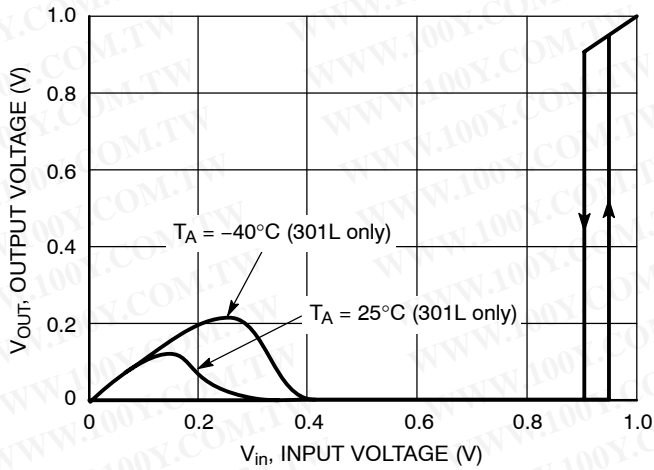


Figure 9. NCP300L/1L Series 0.9 V Reset Output Voltage versus Input Voltage

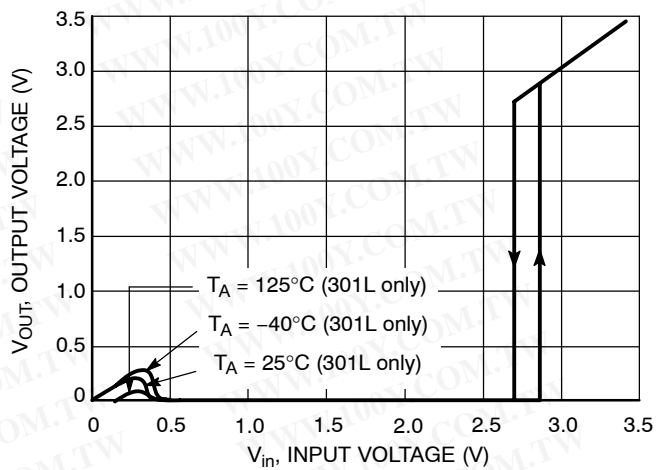


Figure 10. NCP300L/1L Series 2.7 V Reset Output Voltage versus Input Voltage

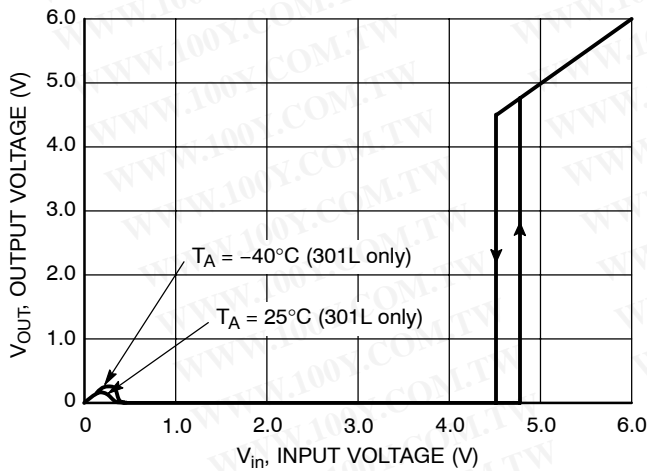


Figure 11. NCP300L/1L Series 4.5 V Reset Output Voltage versus Input Voltage

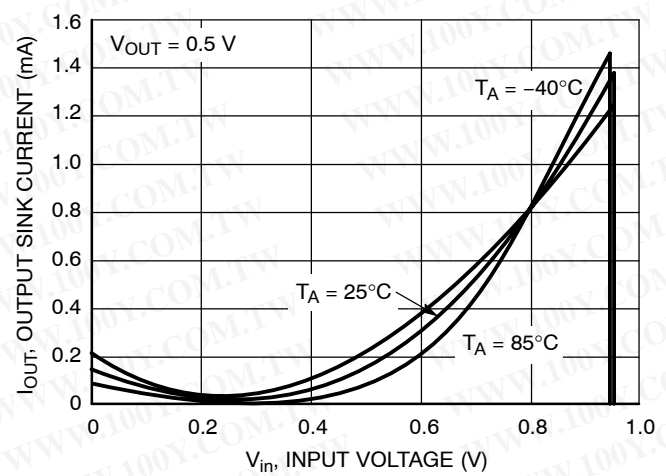


Figure 12. NCP300H/1L Series 0.9 V Reset Output Sink Current versus Input Voltage

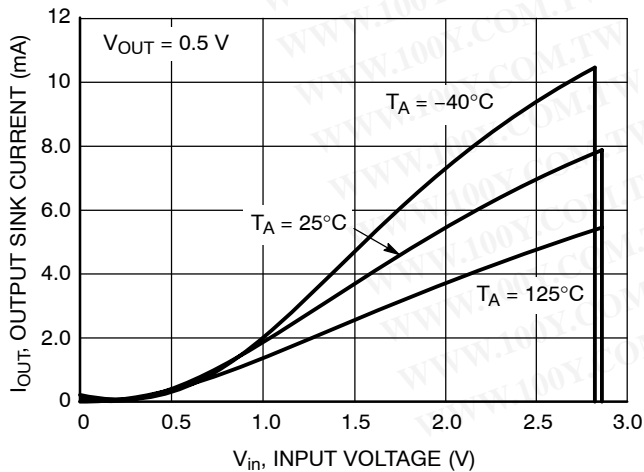


Figure 13. NCP300H/1L Series 2.7 V Reset Output Sink Current versus Input Voltage

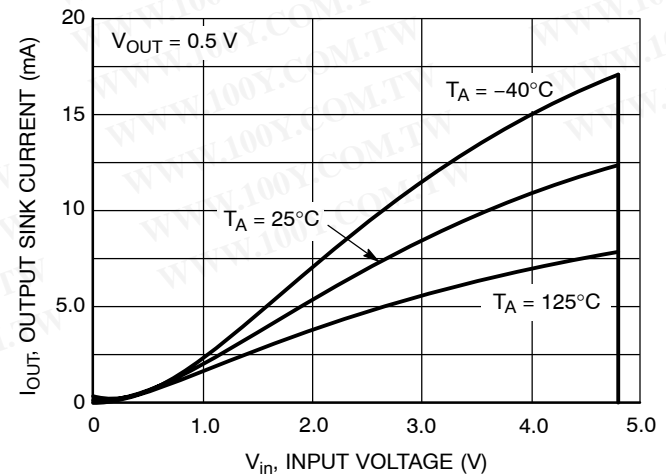


Figure 14. NCP300H/1L Series 4.5 V Reset Output Sink Current versus Input Voltage

NCP300, NCP301

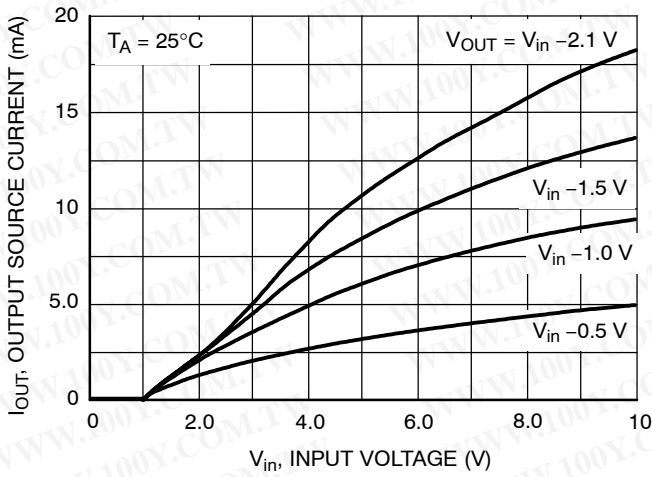


Figure 15. NCP300L Series 0.9 V Reset Output Source Current versus Input Voltage

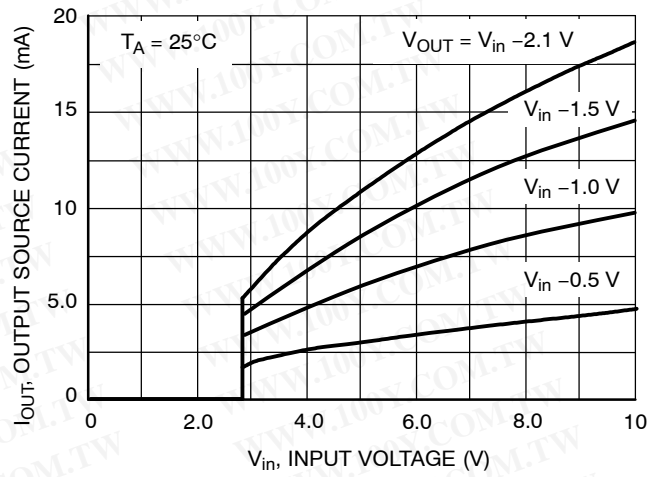


Figure 16. NCP300L Series 2.7 V Reset Output Source Current versus Input Voltage

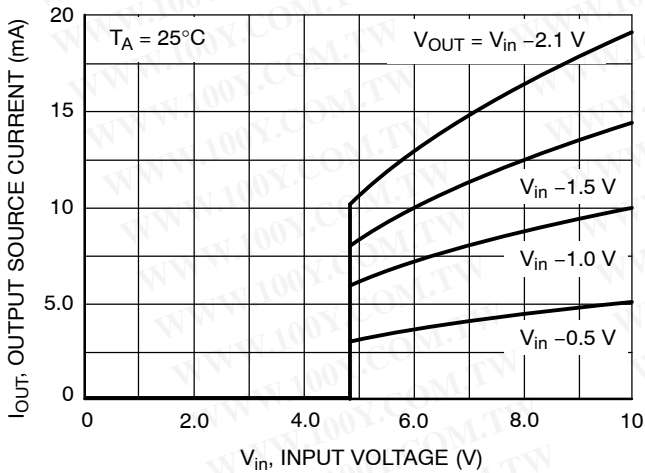


Figure 17. NCP300L Series 4.5 V Reset Output Source Current versus Input Voltage

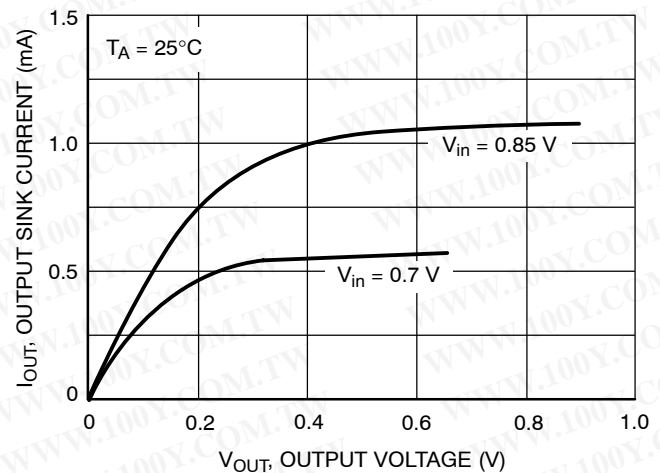


Figure 18. NCP300H/1L Series 0.9 V Reset Output Sink Current versus Output Voltage

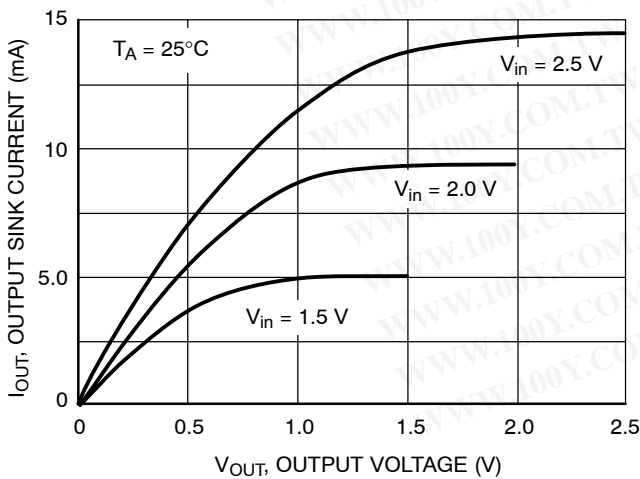


Figure 19. NCP300H/1L Series 2.7 V Reset Output Sink Current versus Output Voltage

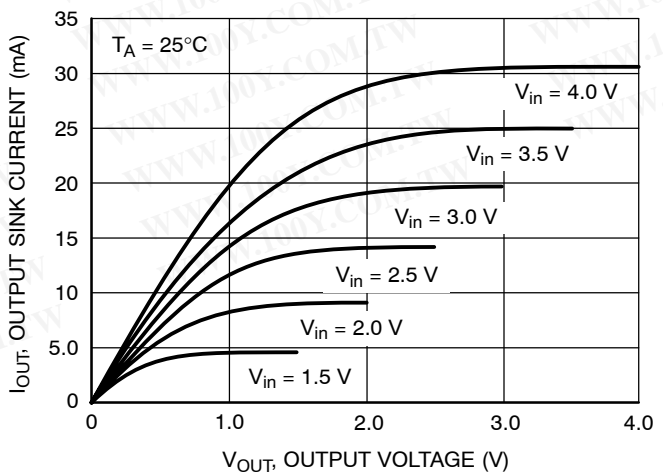


Figure 20. NCP300H/1L Series 4.5 V Reset Output Sink Current versus Output Voltage

NCP300, NCP301

OPERATING DESCRIPTION

The NCP300 and NCP301 series devices are second generation ultra-low current voltage detectors. Figures 20 and 21 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 1) 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 these device series are specifically designed for use as reset controllers in portable microprocessor based systems, they offer a cost-effective solution in numerous applications where precise voltage monitoring is required. Figure 25 through Figure 32 shows various application examples.

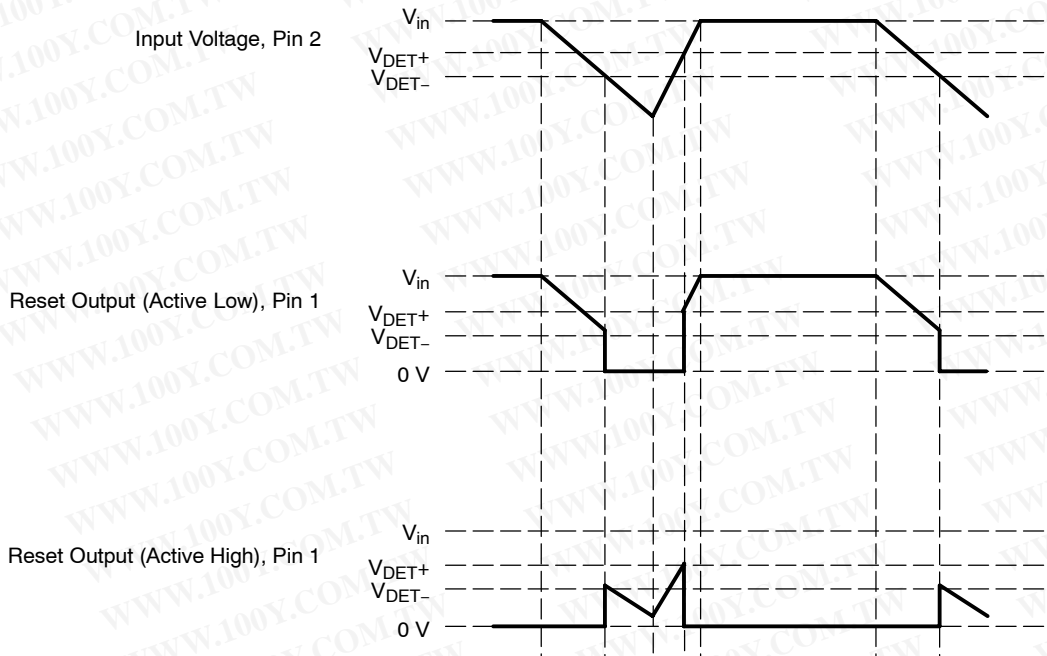


Figure 21. Timing Waveforms

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V_{CC} TRANSIENT REJECTION

The NCP300 and NCP301 series provides accurate V_{CC} monitoring and reset timing during power-up, power-down, and brownout/sag conditions, and rejects negative glitches on the power supply line. Figure 22 shows the maximum transient duration vs. maximum negative excursion (overdrive) for glitch rejection. Any combination of duration and overdrive which lies under the curve will not generate a reset signal. A below-V_{CC} condition (on the right) is detected as a brownout or power-down. Typically, any transient that goes 100 mV below the reset threshold and lasts 5.0 μs or less will not cause a reset pulse.

Transient immunity can be improved by adding a capacitor in close proximity to the V_{CC} pin of the NCP30x.

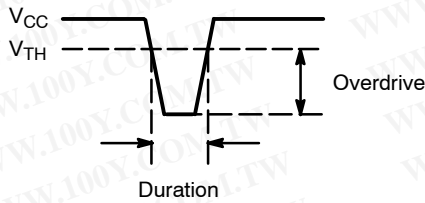


Figure 22. Max Transient Duration vs. Max Overdrive

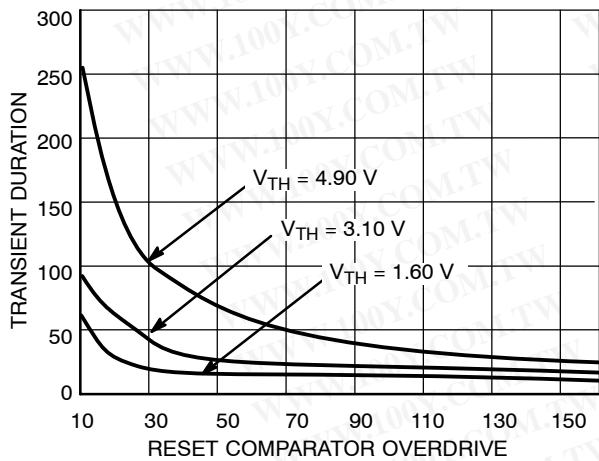


Figure 23.

PROPAGATION DELAY VARIATION

On the other hand (see above paragraph), a minimum overdrive value from V_{threshold} to V_{CC} must be respected. That means V_{in} (minimum value of V_{CC}) must be higher enough than V_{DET⁺} (V_{DET⁻} + hysteresis) at the risk of significantly increasing propagation delay. (Figure 24) This propagation delay is temperature sensitive.

To avoid acceptable time response, a minimum 100 mV difference between V_{in} and V_{DET⁺} must be selected.

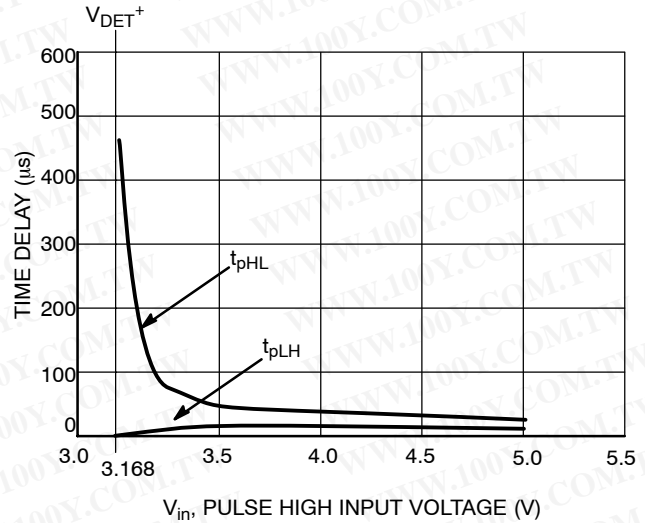


Figure 24. t_{pLH} and t_{pHL} vs. Input Voltage for the NCP301SNT1

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NCP300, NCP301

APPLICATION CIRCUIT INFORMATION

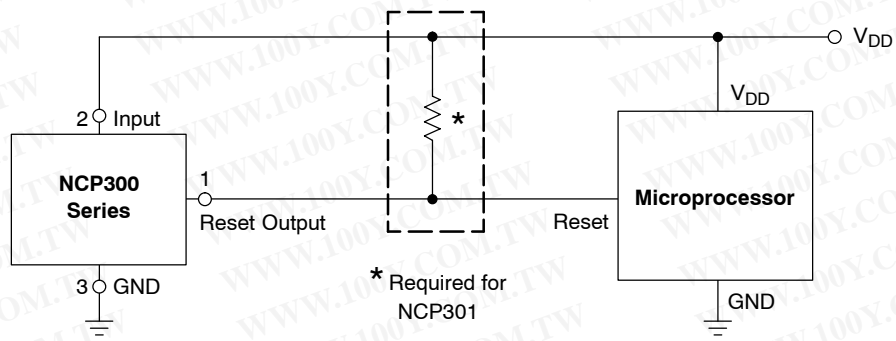


Figure 25. Microprocessor Reset Circuit

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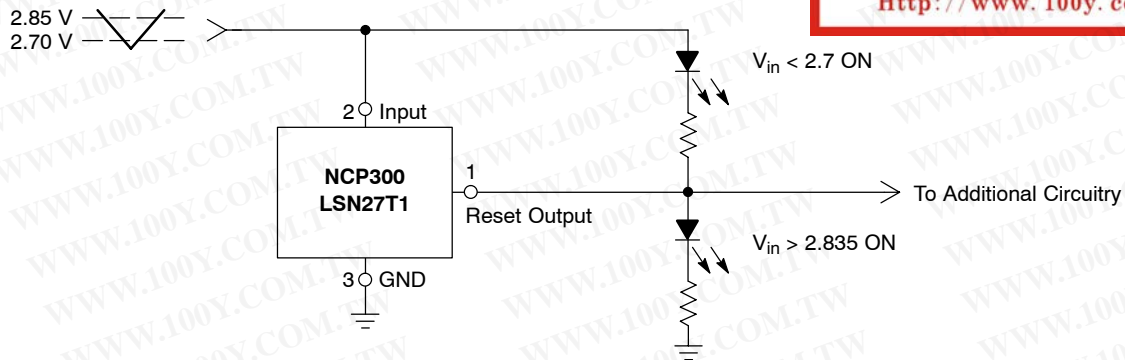
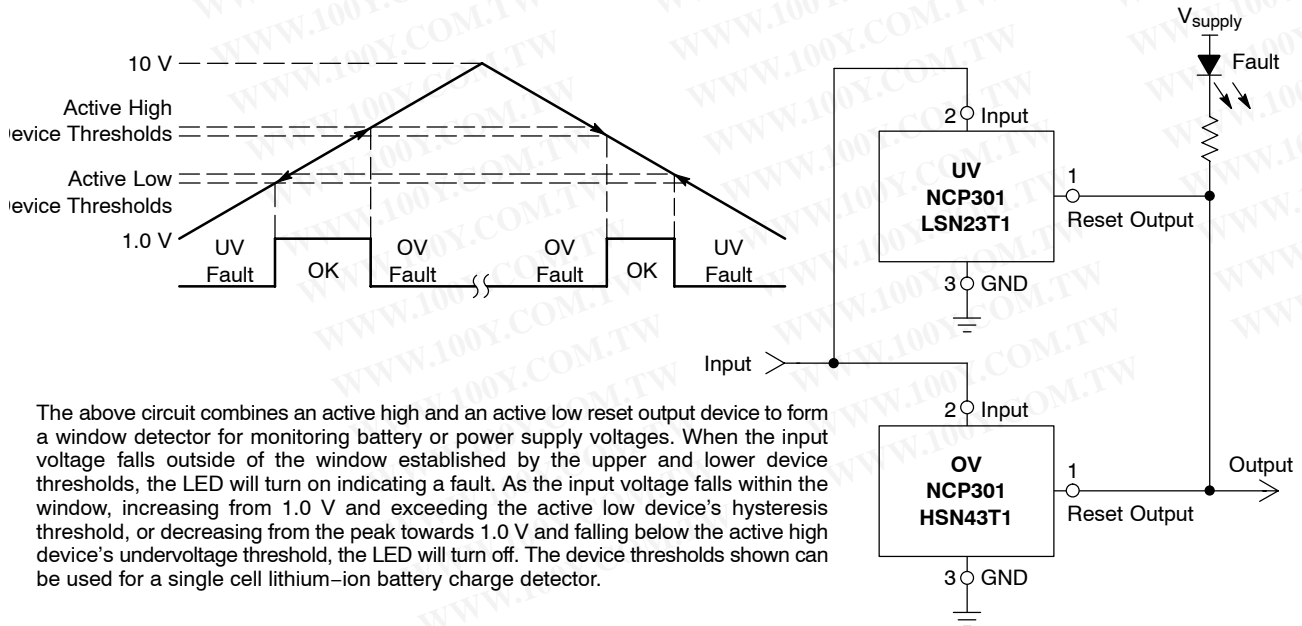


Figure 26. Battery Charge Indicator



The above circuit combines an active high and an active low reset output device to form a window detector for monitoring battery or power supply voltages. When the input voltage falls outside of the window established by the upper and lower device thresholds, the LED will turn on indicating a fault. As the input voltage falls within the window, increasing from 1.0 V and exceeding the active low device's hysteresis threshold, or decreasing from the peak towards 1.0 V and falling below the active high device's undervoltage threshold, the LED will turn off. The device thresholds shown can be used for a single cell lithium-ion battery charge detector.

Figure 27. Window Voltage Detector

NCP300, NCP301

APPLICATION CIRCUIT INFORMATION

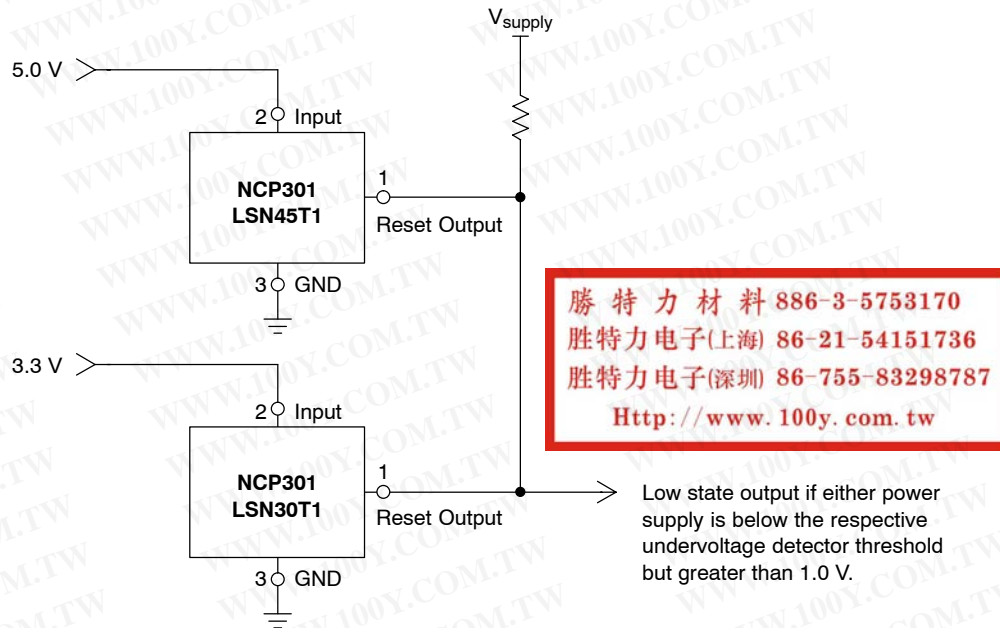


Figure 28. Dual Power Supply Undervoltage Supervision

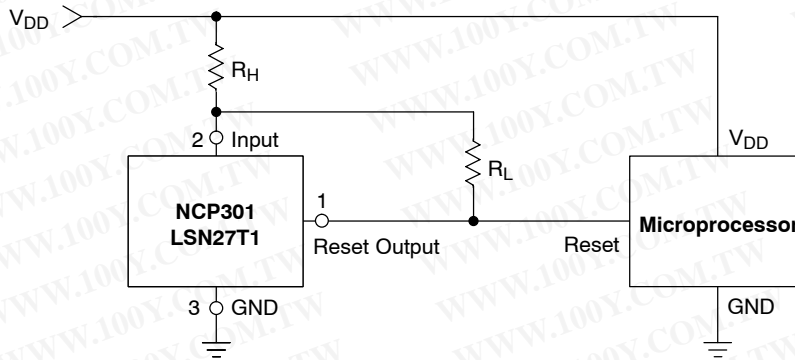


Figure 29. Microprocessor Reset Circuit with Additional Hysteresis

Comparator hysteresis can be increased with the addition of resistor R_H . The hysteresis equations have been simplified and do not account for the change of input current I_{in} as V_{in} crosses the comparator threshold. The internal resistance, R_{in} is simply calculated using $I_{in} = 0.26 \mu A$ at 2.6 V.

V_{in} Decreasing:

$$V_{th} = \left(\frac{R_H}{R_{in}} + 1 \right) (V_{DET-})$$

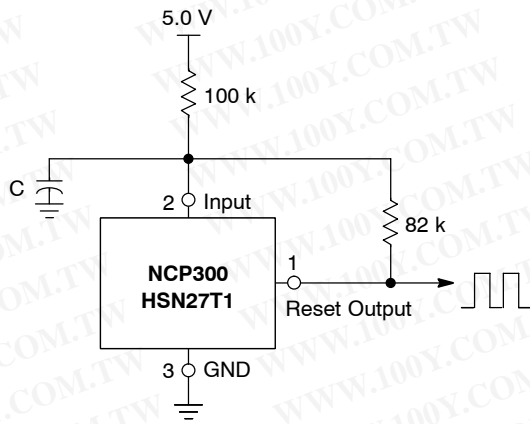
V_{in} Increasing:

$$V_{th} = \left(\frac{R_H}{R_{in} \parallel R_L} + 1 \right) (V_{DET-} + V_{HYS})$$

$$V_{HYS} = V_{in \text{ Increasing}} - V_{in \text{ Decreasing}}$$

| Test Data | | | | |
|-------------------------|-------------------------|---------------|--------------------|---------------------|
| V_{th} Decreasing (V) | V_{th} Increasing (V) | V_{HYS} (V) | R_H (Ω) | R_L (k Ω) |
| 2.70 | 2.84 | 0.135 | 0 | - |
| 2.70 | 2.87 | 0.17 | 100 | 10 |
| 2.70 | 2.88 | 0.19 | 100 | 6.8 |
| 2.70 | 2.91 | 0.21 | 100 | 4.3 |
| 2.70 | 2.90 | 0.20 | 220 | 10 |
| 2.70 | 2.94 | 0.24 | 220 | 6.8 |
| 2.70 | 2.98 | 0.28 | 220 | 4.3 |
| 2.70 | 2.70 | 0.27 | 470 | 10 |
| 2.70 | 3.04 | 0.34 | 470 | 6.8 |
| 2.70 | 3.15 | 0.35 | 470 | 4.3 |

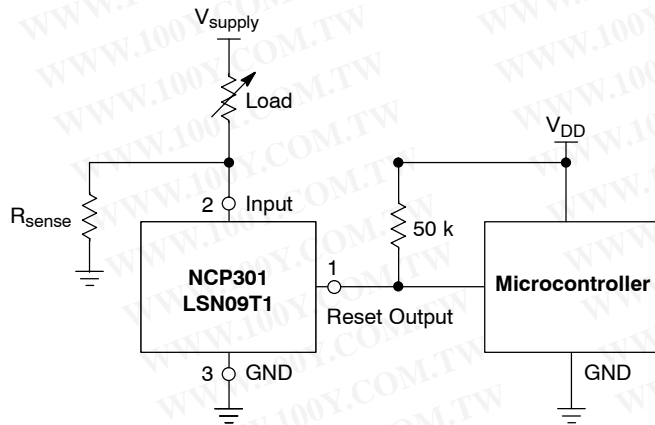
NCP300, NCP301



| Test Data | | |
|-----------|------------------------|---------------------|
| C (μF) | f _{osc} (kHz) | I _Q (μA) |
| 0.01 | 2590 | 21.77 |
| 0.1 | 490 | 21.97 |
| 1.0 | 52 | 22.07 |

Figure 30. Simple Clock Oscillator

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This circuit monitors the current at the load. As current flows through the load, a voltage drop with respect to ground appears across R_{sense} where $V_{sense} = I_{load} * R_{sense}$. The following conditions apply:

If:

$$I_{Load} < V_{DET-} / R_{sense}$$

$$I_{Load} \geq (V_{DET-} + V_{HYS}) / R_{sense}$$

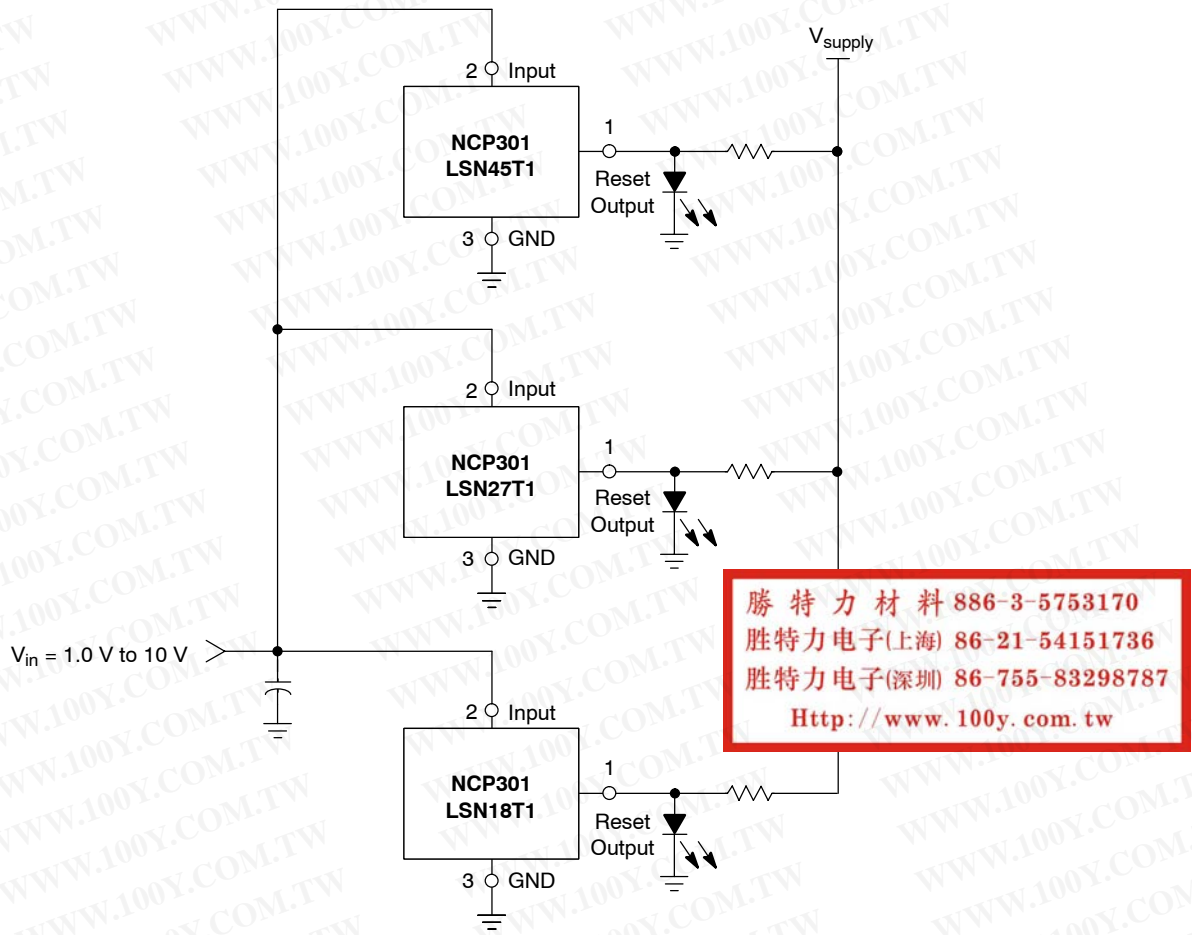
Then:

$$\text{Reset Output} = 0 \text{ V}$$

$$\text{Reset Output} = V_{DD}$$

Figure 31. Microcontroller System Load Sensing

NCP300, NCP301



A simple voltage monitor can be constructed by connecting several voltage detectors as shown above. Each LED will sequentially turn on when the respective voltage detector threshold ($V_{DET} + V_{HYS}$) is exceeded. Note that detector thresholds (V_{DET-}) that range from 0.9 V to 4.9 V in 100 mV steps can be manufactured.

Figure 32. LED Bar Graph Voltage Monitor

NCP300, NCP301

ORDERING INFORMATION

| Device | Threshold Voltage | Output Type | Reset | Marking | Package | Shipping [†] |
|-----------------|-------------------|-------------|---------------------|---------|---------------------|------------------------------------|
| NCP300LSN09T1 | 0.9 | CMOS | Active Low | SEJ | TSOP-5 | 3000 / Tape & Reel (7 in. Reel) |
| NCP300LSN09T1G | 0.9 | | | SEJ | TSOP-5 (Pb-Free) | |
| NCP300LSN18T1 | 1.8 | | | SFK | TSOP-5 | |
| NCP300LSN18T1G | 1.8 | | | SFK | TSOP-5 (Pb-Free) | |
| NCP300LSN20T1 | 2.0 | | | SHE | TSOP-5 | |
| NCP300LSN20T1G | 2.0 | | | SHE | TSOP-5 (Pb-Free) | |
| NCP300LSN27T1 | 2.7 | | | SEE | TSOP-5 | |
| NCP300LSN27T1G | 2.7 | | | SEE | TSOP-5 (Pb-Free) | |
| NCP300LSN28T1 | 2.8 | | | SED | TSOP-5 | |
| NCP300LSN28T1G | 2.8 | | | SED | TSOP-5 (Pb-Free) | |
| NCV300LSN28T1* | 2.8 | | | SSL | TSOP-5 | |
| NCV300LSN28T1G* | 2.8 | | | SSL | TSOP-5 (Pb-Free) | |
| NCP300LSN30T1 | 3.0 | | | SEC | TSOP-5 | |
| NCP300LSN30T1G | 3.0 | | | SEC | TSOP-5 (Pb-Free) | |
| NCP300LSN33T1 | 3.3 | | | SKV | TSOP-5 | |
| NCP300LSN33T1G | 3.3 | | | SKV | TSOP-5 (Pb-Free) | |
| NCP300LSN34T1 | 3.4 | | | SKU | TSOP-5 | |
| NCP300LSN34T1G | 3.4 | | | SKU | TSOP-5 (Pb-Free) | |
| NCP300LSN44T1 | 4.4 | | | SKK | TSOP-5 | |
| NCP300LSN44T1G | 4.4 | | | SKK | TSOP-5 (Pb-Free) | |
| NCP300LSN45T1 | 4.5 | | | SEA | TSOP-5 | |
| NCP300LSN45T1G | 4.5 | | | SEA | TSOP-5 (Pb-Free) | |
| NCP300LSN46T1 | 4.6 | | | SKJ | TSOP-5 | |
| NCP300LSN46T1G | 4.6 | | | SKJ | TSOP-5 (Pb-Free) | |
| NCP300LSN47T1 | 4.7 | SDZ | TSOP-5 | | | |
| NCP300LSN47T1G | 4.7 | SDZ | TSOP-5 (Pb-Free) | | | |
| NCP300LSN185T1 | 1.815 | SRA | TSOP-5 | | | |
| NCP300LSN185T1G | 1.815 | SRA | TSOP-5 (Pb-Free) | | | |

NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and NCP300/NCP301 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. The electrical characteristics of these additional devices are shown in Tables 1 through 4.

[†]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.

*NCV prefix for automotive and other applications requiring site and control changes.
NCVxxx: T_{low} = -40°C, T_{high} = +125°C. Guaranteed by design.

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NCP300, NCP301

ORDERING INFORMATION

| Device | Threshold Voltage | Output Type | Reset | Marking | Package | Shipping [†] | | | |
|-----------------|-------------------|-------------|---------------------|------------|---------------------|------------------------------------|-----|---------------------|------------------------------------|
| NCP300HSN09T1 | 0.9 | CMOS | Active High | SDY | TSOP-5 | 3000 / Tape & Reel (7 in. Reel) | | | |
| NCP300HSN09T1G | 0.9 | | | SDY | TSOP-5 (Pb-Free) | | | | |
| NCP300HSN18T1 | 1.8 | | | SFJ | TSOP-5 | | | | |
| NCP300HSN18T1G | 1.8 | | | SFJ | TSOP-5 (Pb-Free) | | | | |
| NCP300HSN27T1 | 2.7 | | | SDU | TSOP-5 | | | | |
| NCP300HSN27T1G | 2.7 | | | SDU | TSOP-5 (Pb-Free) | | | | |
| NCP300HSN30T1 | 3.0 | | | SDS | TSOP-5 | | | | |
| NCP300HSN30T1G | 3.0 | | | SDS | TSOP-5 (Pb-Free) | | | | |
| NCP300HSN45T1 | 4.5 | | | SDQ | TSOP-5 | | | | |
| NCP300HSN45T1G | 4.5 | | | SDQ | TSOP-5 (Pb-Free) | | | | |
| NCP300HSN47T1 | 4.7 | | | SDP | TSOP-5 | | | | |
| NCP300HSN47T1G | 4.7 | | | SDP | TSOP-5 (Pb-Free) | | | | |
| NCP301LSN09T1 | 0.9 | | | Open Drain | Active Low | | SFF | TSOP-5 | 3000 / Tape & Reel (7 in. Reel) |
| NCP301LSN09T1G | 0.9 | | | | | | SFF | TSOP-5 (Pb-Free) | |
| NCP301LSN12T1 | 1.2 | SNN | TSOP-5 | | | | | | |
| NCP301LSN12T1G | 1.2 | SNN | TSOP-5 (Pb-Free) | | | | | | |
| NCV301LSN12T1* | 1.2 | SRK | TSOP-5 | | | | | | |
| NCV301LSN12T1G* | 1.2 | SRK | TSOP-5 (Pb-Free) | | | | | | |
| NCP301LSN16T1 | 1.6 | SNJ | TSOP-5 | | | | | | |
| NCP301LSN16T1G | 1.6 | SNJ | TSOP-5 (Pb-Free) | | | | | | |
| NCV301LSN16T1* | 1.6 | SRL | TSOP-5 | | | | | | |
| NCV301LSN16T1G* | 1.6 | SRL | TSOP-5 (Pb-Free) | | | | | | |
| NCP301LSN18T1 | 1.8 | SFN | TSOP-5 | | | | | | |
| NCP301LSN18T1G | 1.8 | SFN | TSOP-5 (Pb-Free) | | | | | | |
| NCP301LSN20T1 | 2.0 | SFD | TSOP-5 | | | | | | |
| NCP301LSN20T1G | 2.0 | SFD | TSOP-5 (Pb-Free) | | | | | | |
| NCP301LSN22T1 | 2.2 | SNG | TSOP-5 | | | | | | |
| NCP301LSN22T1G | 2.2 | SNG | TSOP-5 (Pb-Free) | | | | | | |
| NCV301LSN22T1* | 2.2 | SUA | TSOP-5 | | | | | | |
| NCP301LSN25T1 | 2.5 | SNF | TSOP-5 | | | | | | |
| NCP301LSN25T1G | 2.5 | SNF | TSOP-5 (Pb-Free) | | | | | | |
| NCP301LSN26T1 | 2.6 | SNE | TSOP-5 | | | | | | |
| NCP301LSN26T1G | 2.6 | SNE | TSOP-5 (Pb-Free) | | | | | | |

NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and NCP300/NCP301 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. The electrical characteristics of these additional devices are shown in Tables 1 through 4.

[†]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.

*NCV prefix for automotive and other applications requiring site and control changes.
NCVxxx: T_{low} = -40°C, T_{high} = +125°C. Guaranteed by design.

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NCP300, NCP301

ORDERING INFORMATION

| Device | Threshold Voltage | Output Type | Reset | Marking | Package | Shipping [†] |
|-----------------|-------------------|-------------|---------------------|---------|---------------------|------------------------------------|
| NCP301LSN27T1 | 2.7 | Open Drain | Active Low | SFA | TSOP-5 | 3000 / Tape & Reel (7 in. Reel) |
| NCP301LSN27T1G | 2.7 | | | SFA | TSOP-5 (Pb-Free) | |
| NCP301LSN28T1 | 2.8 | | | SEZ | TSOP-5 | |
| NCP301LSN28T1G | 2.8 | | | SEZ | TSOP-5 (Pb-Free) | |
| NCV301LSN28T1* | 2.8 | | | SRO | TSOP-5 | |
| NCV301LSN28T1G* | 2.8 | | | SRO | TSOP-5 (Pb-Free) | |
| NCP301LSN30T1 | 3.0 | | | SEY | TSOP-5 | |
| NCP301LSN30T1G | 3.0 | | | SEY | TSOP-5 (Pb-Free) | |
| NCP301LSN31T1 | 3.1 | | | SEW | TSOP-5 | |
| NCP301LSN31T1G | 3.1 | | | SEW | TSOP-5 (Pb-Free) | |
| NCP301LSN32T1 | 3.2 | | | SNC | TSOP-5 | |
| NCP301LSN32T1G | 3.2 | | | SNC | TSOP-5 (Pb-Free) | |
| NCP301LSN33T1 | 3.3 | | | SNB | TSOP-5 | |
| NCP301LSN33T1G | 3.3 | | | SNB | TSOP-5 (Pb-Free) | |
| NCP301LSN34T1 | 3.4 | | | SNA | TSOP-5 | |
| NCP301LSN34T1G | 3.4 | | | SNA | TSOP-5 (Pb-Free) | |
| NCP301LSN39T1G | 3.4 | | | SNA | TSOP-5 (Pb-Free) | |
| NCP301LSN40T1 | 4.0 | | | SMU | TSOP-5 | |
| NCP301LSN40T1G | 4.0 | | | SMU | TSOP-5 (Pb-Free) | |
| NCV301LSN40T1* | 4.0 | | | SRP | TSOP-5 | |
| NCV301LSN40T1G* | 4.0 | | | SRP | TSOP-5 (Pb-Free) | |
| NCP301LSN42T1 | 4.2 | | | SMS | TSOP-5 | |
| NCP301LSN42T1G | 4.2 | | | SMS | TSOP-5 (Pb-Free) | |
| NCP301LSN45T1 | 4.5 | | | SEV | TSOP-5 | |
| NCP301LSN45T1G | 4.5 | | | SEV | TSOP-5 (Pb-Free) | |
| NCP301LSN46T1 | 4.6 | | | SMP | TSOP-5 | |
| NCP301LSN46T1G | 4.6 | | | SMP | TSOP-5 (Pb-Free) | |
| NCP301LSN47T1 | 4.7 | | | SEU | TSOP-5 | |
| NCP301LSN47T1G | 4.7 | SEU | TSOP-5 (Pb-Free) | | | |

NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and NCP300/NCP301 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. The electrical characteristics of these additional devices are shown in Tables 1 through 4.

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NCP300, NCP301

ORDERING INFORMATION

| Device | Threshold Voltage | Output Type | Reset | Marking | Package | Shipping [†] |
|----------------|-------------------|-------------|-------------|---------|---------------------|------------------------------------|
| NCP301HSN09T1 | 0.9 | Open Drain | Active High | SET | TSOP-5 | 3000 / Tape & Reel (7 in. Reel) |
| NCP301HSN09T1G | 0.9 | | | SET | TSOP-5 (Pb-Free) | |
| NCP301HSN18T1 | 1.8 | | | SFM | TSOP-5 | |
| NCP301HSN18T1G | 1.8 | | | SFM | TSOP-5 (Pb-Free) | |
| NCP301HSN22T1 | 2.2 | | | SMD | TSOP-5 | |
| NCP301HSN22T1G | 2.2 | | | SMD | TSOP-5 (Pb-Free) | |
| NCP301HSN27T1 | 2.7 | | | SEP | TSOP-5 | |
| NCP301HSN27T1G | 2.7 | | | SEP | TSOP-5 (Pb-Free) | |
| NCP301HSN30T1 | 3.0 | | | SEN | TSOP-5 | |
| NCP301HSN30T1G | 3.0 | | | SEN | TSOP-5 (Pb-Free) | |
| NCP301HSN45T1 | 4.5 | | | SEL | TSOP-5 | |
| NCP301HSN45T1G | 4.5 | | | SEL | TSOP-5 (Pb-Free) | |

NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and NCP300/NCP301 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. The electrical characteristics of these additional devices are shown in Tables 1 through 4.

[†]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.

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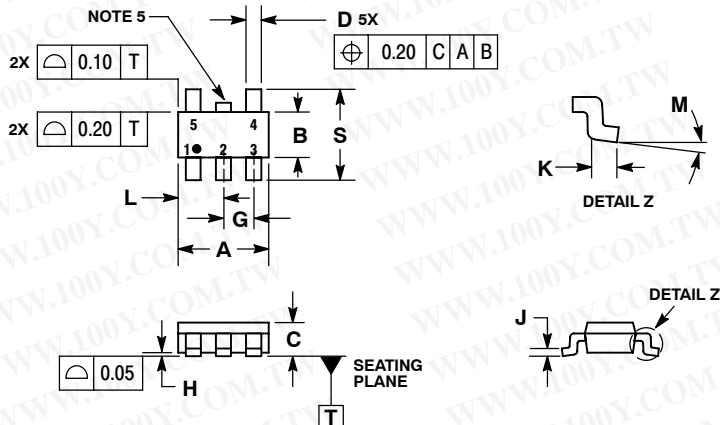
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NCP300, NCP301

PACKAGE DIMENSIONS

TSOP-5
CASE 483-02
ISSUE F

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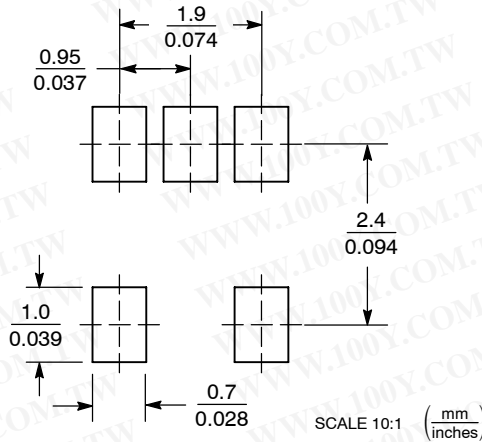


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

| MILLIMETERS | | |
|-------------|------|------|
| DIM | MIN | MAX |
| A | 3.00 | BSC |
| B | 1.50 | BSC |
| C | 0.90 | 1.10 |
| D | 0.25 | 0.50 |
| G | 0.95 | BSC |
| H | 0.01 | 0.10 |
| J | 0.10 | 0.26 |
| K | 0.20 | 0.60 |
| L | 1.25 | 1.55 |
| M | 0° | 10° |
| S | 2.50 | 3.00 |

SOLDERING FOOTPRINT*



*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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