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Voltage Detector Series with Programmable Delay

NCP302, NCP303

The NCP302 and NCP303 series are second generation ultra-low current voltage detectors that contain a programmable time delay generator. 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 and an externally programmable time delay generator. This combination of features prevents erratic system reset operation.

The NCP302 series consists of complementary output devices that are available with either an active high or active low reset. The NCP303 series has an open drain N-Channel output with an active low reset output.

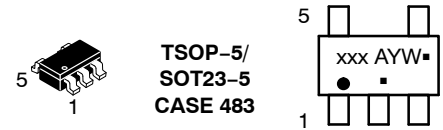
Features

- Quiescent Current of 0.5 μ A Typical
- High Accuracy Undervoltage Threshold of 2.0%
- Externally Programmable Time Delay Generator
- Wide Operating Voltage Range of 0.8 V to 10 V
- Complementary or Open Drain Output
- Active Low or Active High Reset
- Specified Over the -40°C to $+125^{\circ}\text{C}$ Temperature Range (Except for Voltage Options from 0.9 to 1.1 V)
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

Typical Applications

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

MARKING DIAGRAM

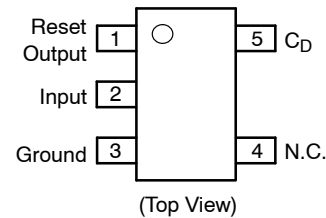


TSOP-5/
SOT23-5
CASE 483

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

(Note: Microdot may be in either location)

PIN CONNECTIONS

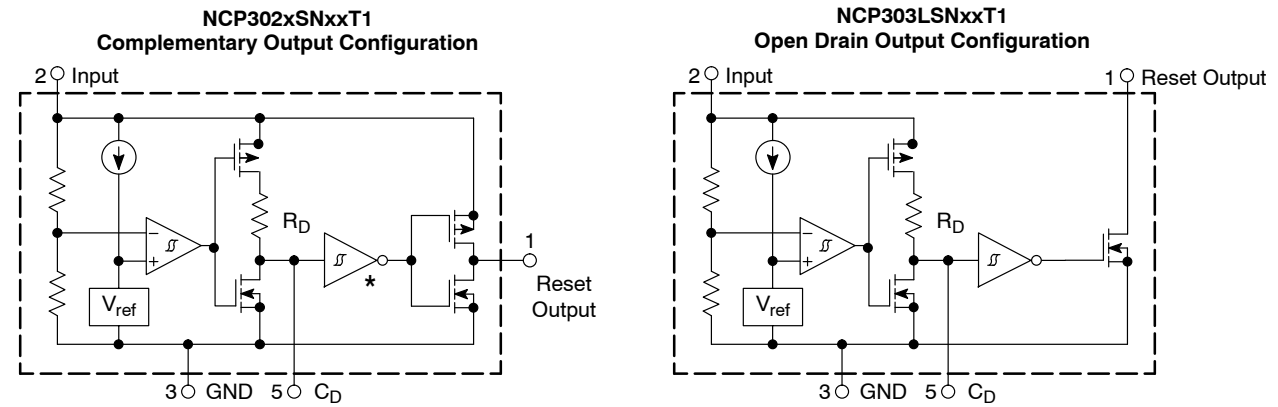


ORDERING INFORMATION

See detailed ordering and shipping information in the ordering information section on page 22 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 23.

NCP302, NCP303



* Inverter for active low devices.
Buffer for active high devices.

This device contains 28 active transistors.

Figure 1. Representative Block Diagrams

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|-----------------|--|----------------------------|
| Input Power Supply Voltage (Pin 2) | V_{in} | 12 | V |
| Delay Capacitor Pin Voltage (Pin 5) | V_{CD} | -0.3 to $V_{in} + 0.3$ | V |
| Output Voltage (Pin 1) Complementary, NCP302 N-Channel Open Drain, NCP303 | 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 | $^{\circ}C/W$ |
| Maximum Junction Temperature | T_J | +150 | $^{\circ}C$ |
| 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 $+125$ | $^{\circ}C$ $^{\circ}C$ |
| Storage Temperature Range | T_{stg} | -55 to $+150$ | $^{\circ}C$ |
| Moisture Sensitivity Level | MSL | 1 | |
| Latchup Performance (Note 3) Positive Negative | $I_{LATCHUP}$ | 200 200 | mA |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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.

NCP302, NCP303

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 |
|--|---------------|----------------------------|-------------------------|-----------------|------------------|
| NCP302/3 – 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) Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 0.85\text{V}$) Pch Source Current, NCP302 ($V_{OUT} = 2.4\text{V}$, $V_{in} = 4.5\text{V}$) | I_{OUT} | 0.01 0.05 1.0 | 0.05 0.50 6.0 | – – – | mA |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 1.5\text{ V}$) Pch Source Current, NCP302 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 0.8\text{ V}$) | I_{OUT} | 1.05 0.011 0.014 | 2.5 0.04 0.08 | – – – | mA |
| C_D Delay Pin Threshold Voltage (Pin 5) ($V_{in} = 0.99\text{ V}$) | V_{TCD} | 0.50 | 0.67 | 0.84 | V |
| Delay Capacitor Pin Sink Current (Pin 5) ($V_{in} = 0.7\text{ V}$, $V_{CD} = 0.1\text{V}$) ($V_{in} = 0.85\text{ V}$, $V_{CD} = 0.5\text{V}$) | I_{CD} | 2.0 10 | 120 300 | – – | μA |
| Delay Pullup Resistance (Pin 5) | R_D | 0.5 | 1.0 | 2.0 | $\text{M}\Omega$ |

NCP302/3 – 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 | 1.800 – | 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) Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 1.5\text{V}$) Pch Source Current, NCP302 ($V_{OUT} = 2.4\text{V}$, $V_{in} = 4.5\text{V}$) | I_{OUT} | 0.01 1.0 1.0 | 0.05 2.0 6.0 | – – – | mA |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 5.0\text{ V}$) Pch Source Current, NCP302 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{ V}$) | I_{OUT} | 6.3 0.011 0.525 | 11 0.04 0.6 | – – – | mA |
| C_D Delay Pin Threshold Voltage (Pin 5) ($V_{in} = 1.98\text{ V}$) | V_{TCD} | 0.99 | 1.34 | 1.68 | V |

NCP302, NCP303

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 |
|--|---------------|---------------------------|------------------------|-----------------|------------------|
| NCP302/3 – 1.8 | | | | | |
| Delay Capacitor Pin Sink Current (Pin 5) ($V_{in} = 0.7\text{ V}$, $V_{CD} = 0.1\text{V}$) ($V_{in} = 1.5\text{ V}$, $V_{CD} = 0.5\text{V}$) | I_{CD} | 2.0 200 | 120 1600 | – – | μA |
| Delay Pullup Resistance (Pin 5) | R_D | 0.5 | 1.0 | 2.0 | $\text{M}\Omega$ |
| NCP302/3 – 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) Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 1.5\text{V}$) Pch Source Current, NCP302 ($V_{OUT} = 2.4\text{V}$, $V_{in} = 4.5\text{V}$) | 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) Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 5.0\text{ V}$) Pch Source Current, NCP302 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{ V}$) | I_{OUT} | 6.3 0.011 0.525 | 11 0.04 0.6 | – – – | mA |
| C_D Delay Pin Threshold Voltage (Pin 5) ($V_{in} = 2.2\text{ V}$) | V_{TCD} | 1.10 | 1.49 | 1.87 | V |
| Delay Capacitor Pin Sink Current (Pin 5) ($V_{in} = 0.7\text{ V}$, $V_{CD} = 0.1\text{V}$) ($V_{in} = 1.5\text{ V}$, $V_{CD} = 0.5\text{V}$) | I_{CD} | 2.0 200 | 250 3600 | – – | μA |
| Delay Pullup Resistance (Pin 5) | R_D | 0.5 | 1.0 | 2.0 | $\text{M}\Omega$ |
| NCP302/3– 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) Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 1.5\text{V}$) Pch Source Current, NCP302 ($V_{OUT} = 2.4\text{V}$, $V_{in} = 4.5\text{V}$) | 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) Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 5.0\text{ V}$) | I_{OUT} | 6.3 | 11 | – | mA |

NCP302, NCP303

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 |
|--|---------------|-----------------------|--------------------|----------------|------------------|
| NCP302/3 – 2.7 | | | | | |
| Pch Source Current, NCP302 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{ V}$) | | 0.011 0.525 | 0.04 0.6 | – – | |
| C_D Delay Pin Threshold Voltage (Pin 5) ($V_{in} = 2.97\text{ V}$) | V_{TCD} | 1.49 | 2.01 | 2.53 | V |
| Delay Capacitor Pin Sink Current (Pin 5) ($V_{in} = 0.7\text{ V}$, $V_{CD} = 0.1\text{ V}$) ($V_{in} = 1.5\text{ V}$, $V_{CD} = 0.5\text{ V}$) | I_{CD} | 2.0 200 | 250 3600 | – – | μA |
| Delay Pullup Resistance (Pin 5) | R_D | 0.5 | 1.0 | 2.0 | $\text{M}\Omega$ |
| NCP302/3 – 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) Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.05\text{ V}$, $V_{in} = 0.70\text{ V}$) ($V_{OUT} = 0.50\text{ V}$, $V_{in} = 1.5\text{ V}$) Pch Source Current, NCP302 ($V_{OUT} = 2.4\text{ V}$, $V_{in} = 4.5\text{ V}$) | 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) Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.5\text{ V}$, $V_{in} = 5.0\text{ V}$) Pch Source Current, NCP302 ($V_{OUT} = 0.4\text{ V}$, $V_{in} = 0.7\text{ V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{ V}$) | I_{OUT} | 6.3 0.011 0.525 | 11 0.04 0.6 | – – – | mA |
| C_D Delay Pin Threshold Voltage (Pin 5) ($V_{in} = 3.3\text{ V}$) | V_{TCD} | 1.65 | 2.23 | 2.81 | V |
| Delay Capacitor Pin Sink Current (Pin 5) ($V_{in} = 0.7\text{ V}$, $V_{CD} = 0.1\text{ V}$) ($V_{in} = 1.5\text{ V}$, $V_{CD} = 0.5\text{ V}$) | I_{CD} | 2.0 200 | 250 3600 | – – | μA |
| Delay Pullup Resistance (Pin 5) | R_D | 0.5 | 1.0 | 2.0 | $\text{M}\Omega$ |
| NCP302/3 – 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) Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.05\text{ V}$, $V_{in} = 0.70\text{ V}$) ($V_{OUT} = 0.50\text{ V}$, $V_{in} = 1.5\text{ V}$) | I_{OUT} | 0.01 1.0 | 0.05 2.0 | – – | mA |

NCP302, NCP303

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

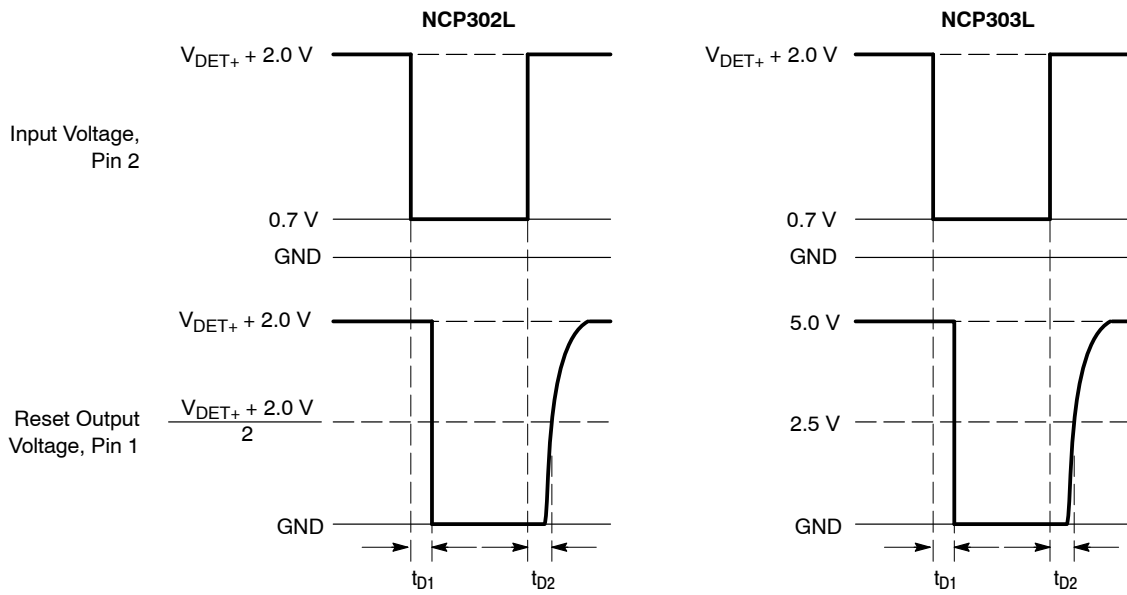
| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|-----------|----------------|-------------|--------|------------------|
| NCP302/3 – 4.5 | | | | | |
| Pch Source Current, NCP302 ($V_{OUT} = 5.9\text{V}$, $V_{in} = 8.0\text{V}$) | | 1.5 | 10.5 | – | |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) | I_{OUT} | | | | mA |
| Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.5\text{V}$, $V_{in} = 5.0\text{V}$) | | 6.3 | 11 | – | |
| Pch Source Current, NCP302 ($V_{OUT} = 0.4\text{V}$, $V_{in} = 0.7\text{V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{V}$) | | 0.011 0.525 | 0.04 0.6 | – – | |
| C_D Delay Pin Threshold Voltage (Pin 5) ($V_{in} = 4.95\text{V}$) | V_{TCD} | 2.25 | 3.04 | 3.83 | V |
| Delay Capacitor Pin Sink Current (Pin 5) ($V_{in} = 0.7\text{V}$, $V_{CD} = 0.1\text{V}$) ($V_{in} = 1.5\text{V}$, $V_{CD} = 0.5\text{V}$) | I_{CD} | 2.0 200 | 120 1600 | – – | μA |
| Delay Pullup Resistance (Pin 5) | R_D | 0.5 | 1.0 | 2.0 | $\text{M}\Omega$ |

NCP302/3 – 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) | I_{OUT} | | | | mA |
| Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.05\text{V}$, $V_{in} = 0.70\text{V}$) ($V_{OUT} = 0.50\text{V}$, $V_{in} = 1.5\text{V}$) | | 0.01 1.0 | 0.05 2.0 | – – | |
| Pch Source Current, NCP302 ($V_{OUT} = 5.9\text{V}$, $V_{in} = 8.0\text{V}$) | | 1.5 | 10.5 | – | |
| Reset Output Current (Pin 1, Active High 'H' Suffix Devices) | I_{OUT} | | | | mA |
| Nch Sink Current, NCP302, NCP303 ($V_{OUT} = 0.5\text{V}$, $V_{in} = 5.0\text{V}$) | | 6.3 | 11 | – | |
| Pch Source Current, NCP302 ($V_{OUT} = 0.4\text{V}$, $V_{in} = 0.7\text{V}$) ($V_{OUT} = \text{GND}$, $V_{in} = 1.5\text{V}$) | | 0.011 0.525 | 0.04 0.6 | – – | |
| C_D Delay Pin Threshold Voltage (Pin 5) ($V_{in} = 5.17\text{V}$) | V_{TCD} | 2.59 | 3.49 | 4.40 | V |
| Delay Capacitor Pin Sink Current (Pin 5) ($V_{in} = 0.7\text{V}$, $V_{CD} = 0.1\text{V}$) ($V_{in} = 1.5\text{V}$, $V_{CD} = 0.5\text{V}$) | I_{CD} | 2.0 200 | 120 1600 | – – | μA |
| Delay Pullup Resistance (Pin 5) | R_D | 0.5 | 1.0 | 2.0 | $\text{M}\Omega$ |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

NCP302, NCP303



NCP302 and NCP303 series are measured with a 10 pF capacitive load. NCP303 has an additional 470 k pullup resistor connected from the reset output to +5.0 V. The reset output voltage waveforms are shown for the active low 'L' devices. Output time delay t_{D1} and t_{D2} are dependent upon the delay capacitance. Refer to Figures 30, 31, and 32. The upper detector threshold, V_{DET+} is the sum of the lower detector threshold, V_{DET-} plus the input hysteresis, V_{HYS} .

Figure 2. Measurement Conditions for t_{D1} and t_{D2}

NCP302, NCP303

Table 1. ELECTRICAL CHARACTERISTIC TABLE FOR 0.9 – 4.9 V

| NCP302 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 | I _{OUT} (mA) |
| 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 |
| NCP302LSN09T1 | 0.882 | 0.9 | 0.918 | 0.027 | 0.045 | 0.063 | 0.20 | 0.45 | 0.05 | 0.5 | 2.0 |
| NCP302LSN15T1 | 1.470 | 1.5 | 1.530 | 0.045 | 0.075 | 0.105 | | | | | |
| NCP302LSN18T1 | 1.764 | 1.8 | 1.836 | 0.054 | 0.090 | 0.126 | 0.23 | 0.48 | | | |
| NCP302LSN20T1 | 1.960 | 2.0 | 2.040 | 0.060 | 0.100 | 0.140 | | | | | |
| NCP302LSN27T1 | 2.646 | 2.7 | 2.754 | 0.081 | 0.135 | 0.189 | 0.25 | 0.50 | | | |
| NCP302LSN30T1, | 2.940 | 3.0 | 3.060 | 0.090 | 0.150 | 0.210 | | | | | |
| NCV302LSN30T1, | 2.940 | 3.0 | 3.060 | 0.090 | 0.150 | 0.210 | | | | | |
| NCP302LSN33T1 | 3.234 | 3.3 | 3.366 | 0.099 | 0.165 | 0.231 | | | | | |
| NCP302LSN38T1 | 3.724 | 3.8 | 3.876 | 0.114 | 0.190 | 0.266 | | | | | |
| NCP302LSN40T1 | 3.920 | 4.0 | 4.080 | 0.120 | 0.200 | 0.280 | 0.33 | 0.52 | | | |
| NCP302LSN43T1 | 4.214 | 4.3 | 4.386 | 0.129 | 0.215 | 0.301 | | | | | |
| NCP302LSN45T1 | 4.410 | 4.5 | 4.590 | 0.135 | 0.225 | 0.315 | 0.34 | 0.53 | | | |
| NCP302LSN47T1 | 4.606 | 4.7 | 4.794 | 0.141 | 0.235 | 0.329 | | | 3.0 | | |

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

| NCP302 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 |
| NCP302HSN09T1 | 0.882 | 0.9 | 0.918 | 0.027 | 0.045 | 0.063 | 0.20 | 0.45 | 2.5 | 0.04 | 0.08 |
| NCP302HSN18T1 | 1.764 | 1.8 | 1.836 | 0.054 | 0.090 | 0.126 | | | | | |
| NCP302HSN27T1 | 2.646 | 2.7 | 2.754 | 0.081 | 0.135 | 0.189 | 0.25 | 0.50 | | | |
| NCP302HSN30T1 | 2.940 | 3.0 | 3.060 | 0.090 | 0.150 | 0.210 | | | | | |
| NCP302HSN40T1 | 3.920 | 4.0 | 4.080 | 0.120 | 0.200 | 0.280 | 0.33 | 0.52 | | | |
| NCP302HSN45T1 | 4.410 | 4.5 | 4.590 | 0.135 | 0.225 | 0.315 | | | | | |

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

NCP302, NCP303

Table 3. ELECTRICAL CHARACTERISTIC TABLE FOR 0.9 – 4.9 V

| NCP303 Series | Detector Threshold | | | Detector Threshold Hysteresis | | | Supply Current | | Nch Sink Current | | |
|---------------|---------------------------------|-----|-------|-------------------------------|-------|-------|--------------------------------|--------------------------------|---------------------------------|---------------------------------|-----|
| | | | | | | | V _{in} Low | V _{in} High | V _{in} Low | V _{in} High | |
| Part Number | V _{DET-} (V) (Note 16) | | | V _{HYS} (V) | | | I _{in} (μA) (Note 17) | I _{in} (μA) (Note 18) | I _{OUT} (mA) (Note 19) | I _{OUT} (mA) (Note 20) | |
| | Min | Typ | Max | Min | Typ | Max | Typ | Typ | Typ | Typ | |
| NCP303LSN09T1 | 0.882 | 0.9 | 0.918 | 0.027 | 0.045 | 0.063 | 0.20 | 0.45 | 0.05 | 0.5 | |
| NCP303LSN10T1 | 0.980 | 1.0 | 1.020 | 0.030 | 0.050 | 0.070 | | | | 1.0 | |
| NCP303LSN11T1 | 1.078 | 1.1 | 1.122 | 0.033 | 0.055 | 0.077 | | | | | |
| NCP303LSN13T1 | 1.274 | 1.3 | 1.326 | 0.039 | 0.065 | 0.091 | | | | | |
| NCP303LSN14T1 | 1.372 | 1.4 | 1.428 | 0.042 | 0.070 | 0.098 | | | | | |
| NCP303LSN15T1 | 1.470 | 1.5 | 1.530 | 0.045 | 0.075 | 0.105 | | | | | |
| NCP303LSN16T1 | 1.568 | 1.6 | 1.632 | 0.048 | 0.080 | 0.112 | | | | | 2.0 |
| NCP303LSN17T1 | 1.666 | 1.7 | 1.734 | 0.051 | 0.085 | 0.119 | | | | | |
| NCP303LSN18T1 | 1.764 | 1.8 | 1.836 | 0.054 | 0.090 | 0.126 | 0.23 | 0.48 | | | |
| NCP303LSN20T1 | 1.960 | 2.0 | 2.040 | 0.060 | 0.100 | 0.140 | | | | | |
| NCP303LSN22T1 | 2.156 | 2.2 | 2.244 | 0.066 | 0.110 | 0.154 | 0.25 | 0.50 | | | |
| NCP303LSN23T1 | 2.254 | 2.3 | 2.346 | 0.069 | 0.115 | 0.161 | | | | | |
| NCP303LSN24T1 | 2.352 | 2.4 | 2.448 | 0.072 | 0.120 | 0.168 | | | | | |
| NCP303LSN25T1 | 2.450 | 2.5 | 2.550 | 0.075 | 0.125 | 0.175 | | | | | |
| NCP303LSN26T1 | 2.548 | 2.6 | 2.652 | 0.078 | 0.130 | 0.182 | | | | | |
| NCP303LSN27T1 | 2.646 | 2.7 | 2.754 | 0.081 | 0.135 | 0.189 | | | | | |
| NCP303LSN28T1 | 2.744 | 2.8 | 2.856 | 0.084 | 0.140 | 0.196 | | | | | |
| NCP303LSN29T1 | 2.842 | 2.9 | 2.958 | 0.087 | 0.145 | 0.203 | | | | | |
| NCP303LSN30T1 | 2.940 | 3.0 | 3.060 | 0.090 | 0.150 | 0.210 | | | | | |
| NCP303LSN31T1 | 3.038 | 3.1 | 3.162 | 0.093 | 0.155 | 0.217 | | | | | |
| NCP303LSN32T1 | 3.136 | 3.2 | 3.264 | 0.096 | 0.160 | 0.224 | | | | | |
| NCP303LSN33T1 | 3.234 | 3.3 | 3.366 | 0.099 | 0.165 | 0.231 | | | 0.33 | 0.52 | |
| NCP303LSN34T1 | 3.332 | 3.4 | 3.468 | 0.102 | 0.170 | 0.238 | | | | | |
| NCP303LSN36T1 | 3.528 | 3.6 | 3.672 | 0.108 | 0.180 | 0.252 | | | | | |
| NCP303LSN38T1 | 3.724 | 3.8 | 3.876 | 0.114 | 0.190 | 0.266 | | | | | |
| NCP303LSN40T1 | 3.920 | 4.0 | 4.080 | 0.120 | 0.200 | 0.280 | | | | | |
| NCP303LSN42T1 | 4.116 | 4.2 | 4.284 | 0.126 | 0.210 | 0.294 | | | | | |
| NCP303LSN44T1 | 4.312 | 4.4 | 4.488 | 0.132 | 0.220 | 0.308 | | | | | |
| NCP303LSN45T1 | 4.410 | 4.5 | 4.590 | 0.135 | 0.225 | 0.315 | | | | | |
| NCP303LSN46T1 | 4.508 | 4.6 | 4.692 | 0.138 | 0.230 | 0.322 | 0.34 | 0.53 | | | |
| NCP303LSN47T1 | 4.606 | 4.7 | 4.794 | 0.141 | 0.235 | 0.329 | | | | | |
| NCP303LSN49T1 | 4.802 | 4.9 | 4.998 | 0.147 | 0.245 | 0.343 | | | | | |

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

NCP302, NCP303

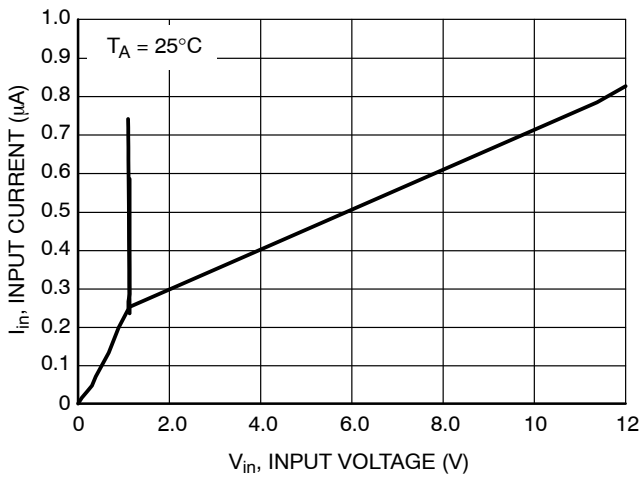


Figure 3. NCP302/3 Series 0.9 V Input Current vs. Input Voltage

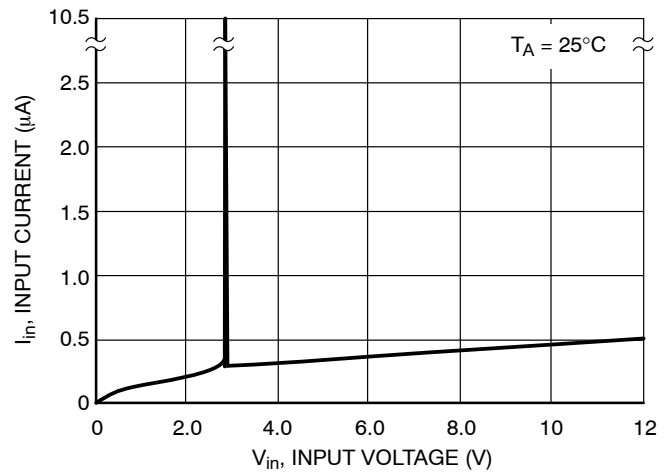


Figure 4. NCP302/3 Series 2.7 V Input Current vs. Input Voltage

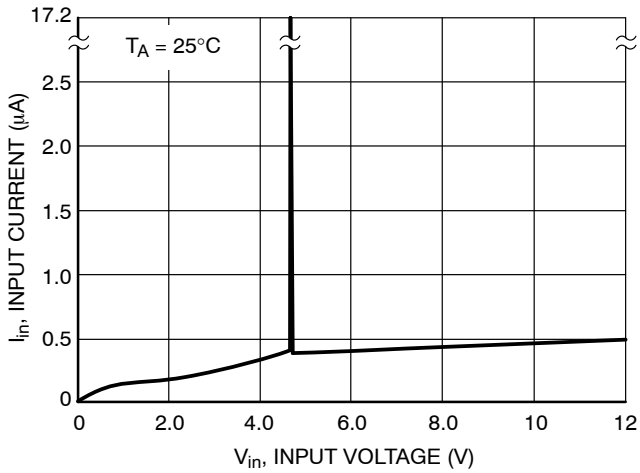


Figure 5. NCP302/3 Series 4.5 V Input Current vs. Input Voltage

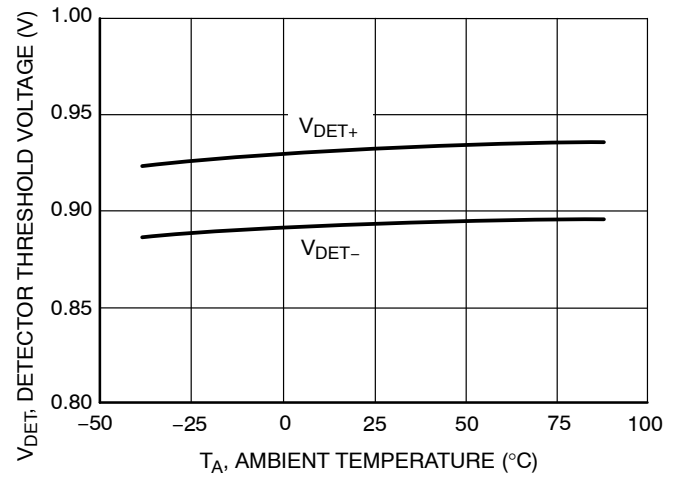


Figure 6. NCP302/3 Series 0.9 V Detector Threshold Voltage vs. Temperature

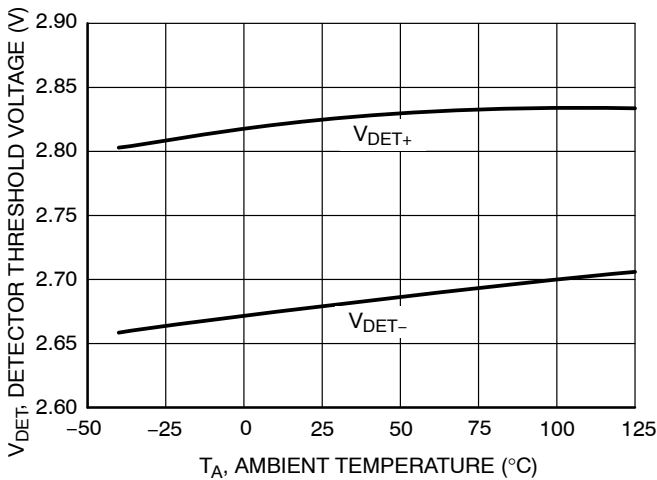


Figure 7. NCP302/3 Series 2.7 V Detector Threshold Voltage vs. Temperature

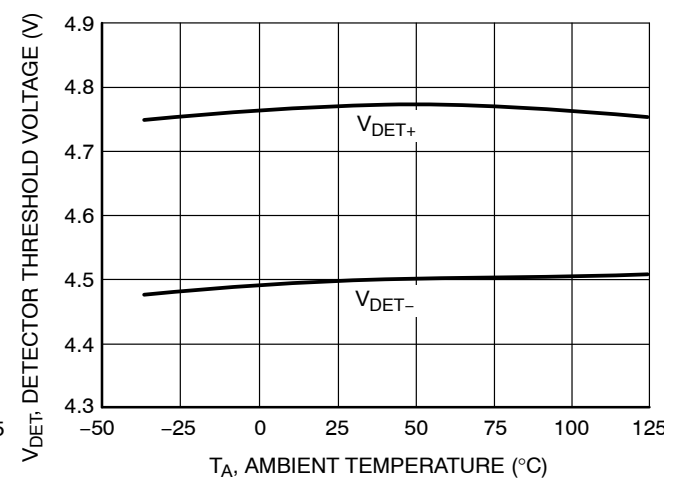


Figure 8. NCP302/3 Series 4.5 V Detector Threshold Voltage vs. Temperature

NCP302, NCP303

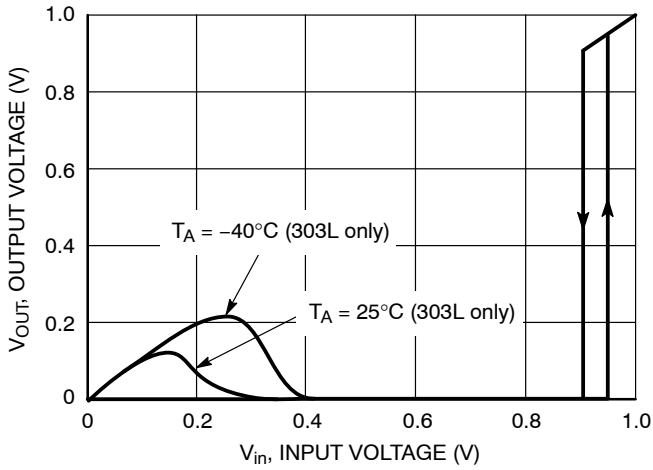


Figure 9. NCP302L/3L Series 0.9 V Reset Output Voltage vs. Input Voltage

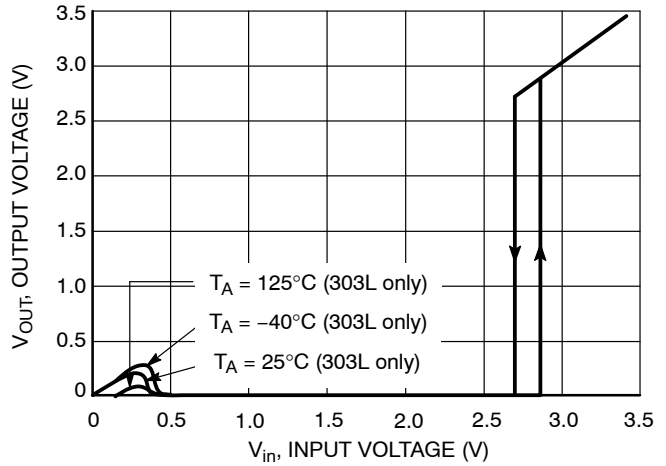


Figure 10. NCP302L/3L Series 2.7 V Reset Output Voltage vs. Input Voltage

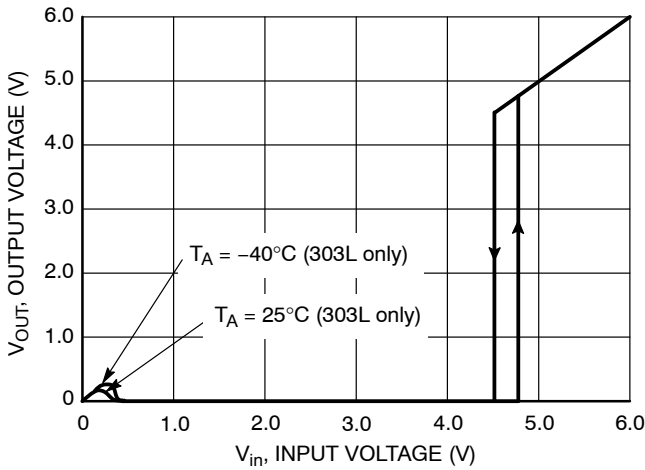


Figure 11. NCP302L/3L Series 4.5 V Reset Output Voltage vs. Input Voltage

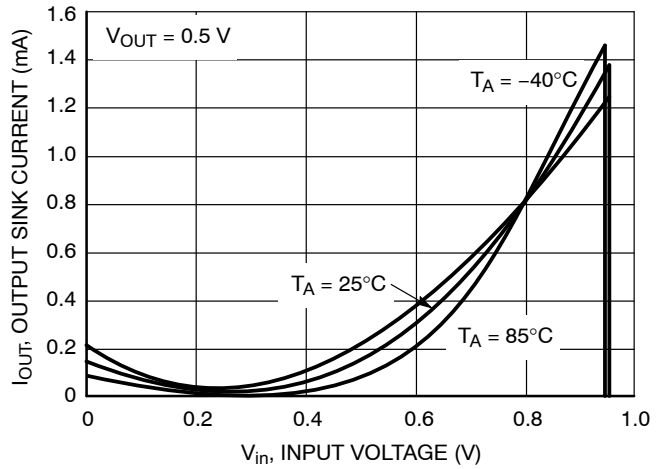


Figure 12. NCP302H/3L Series 0.9 V Reset Output Sink Current vs. Input Voltage

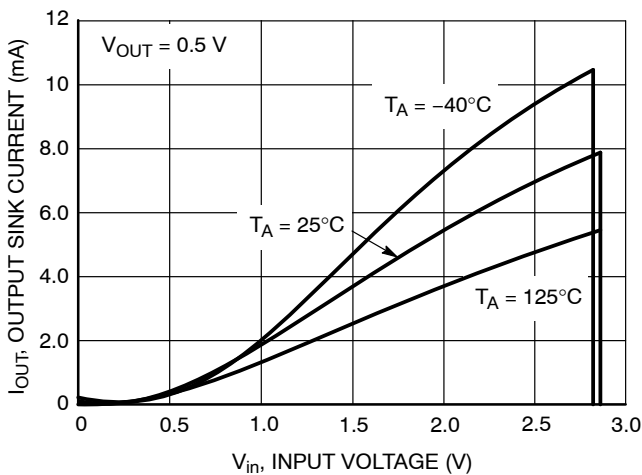


Figure 13. NCP302H/3L Series 2.7 V Reset Output Sink Current vs. Input Voltage

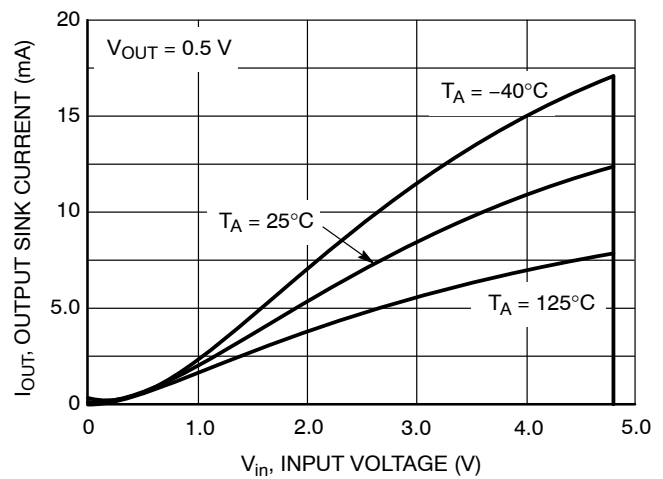


Figure 14. NCP302H/3L Series 4.5 V Reset Output Sink Current vs. Input Voltage

NCP302, NCP303

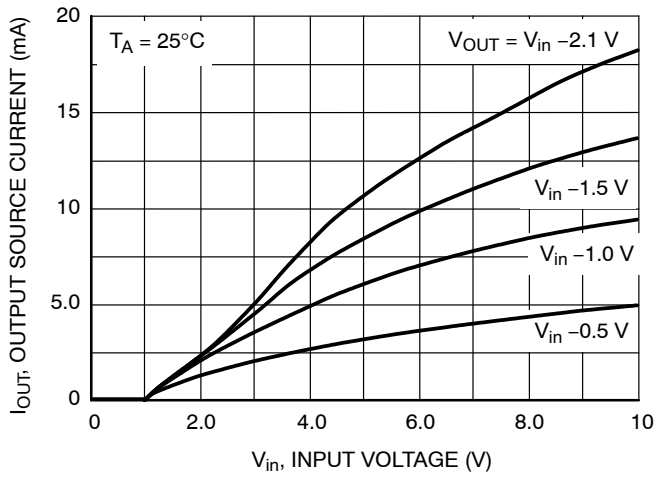


Figure 15. NCP302L Series 0.9 V
Reset Output Source Current vs. Input Voltage

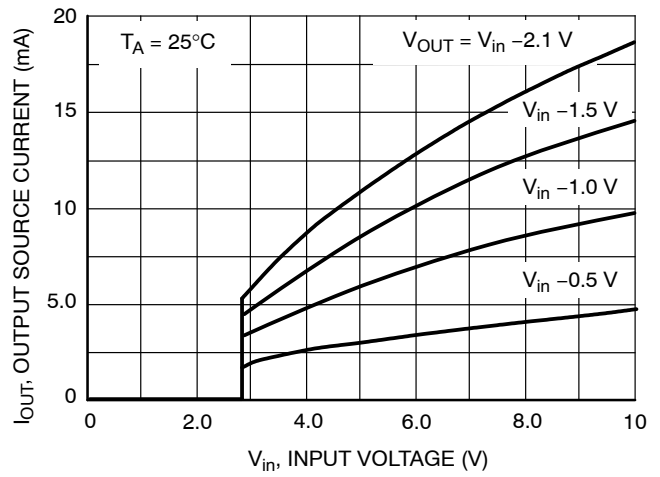


Figure 16. NCP302L Series 2.7 V
Reset Output Source Current vs. Input Voltage

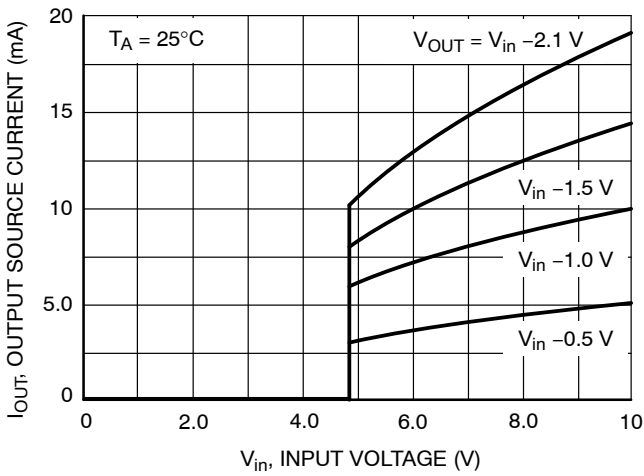


Figure 17. NCP302L Series 4.5 V
Reset Output Source Current vs. Input Voltage

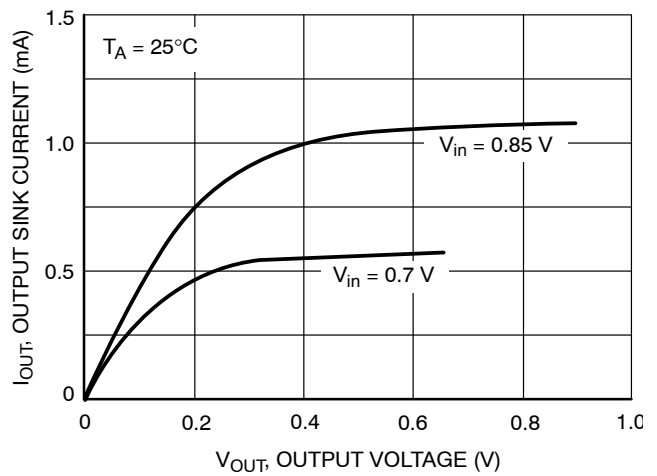


Figure 18. NCP302H/3L Series 0.9 V
Reset Output Sink Current vs. Output Voltage

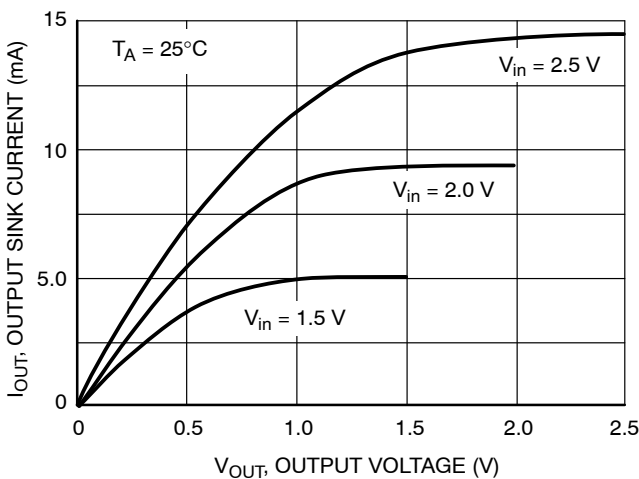


Figure 19. NCP302H/3L Series 2.7 V
Reset Output Sink Current vs. Output Voltage

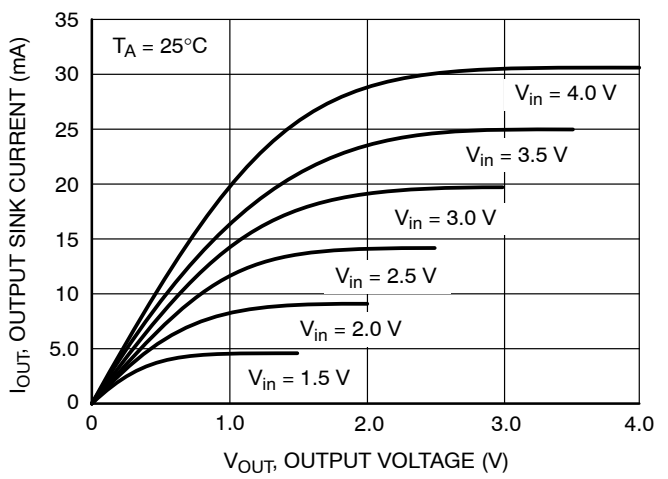


Figure 20. NCP302H/3L Series 4.5 V
Reset Output Sink Current vs. Output Voltage

NCP302, NCP303

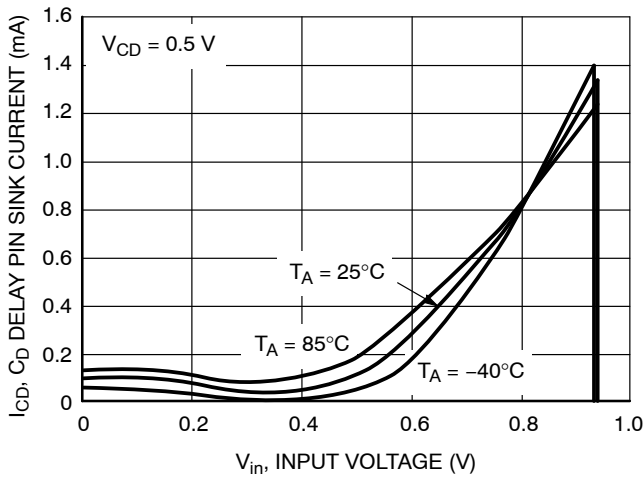


Figure 21. NCP302/3 Series 0.9 V
C_D Delay Pin Sink Current vs. Input Voltage

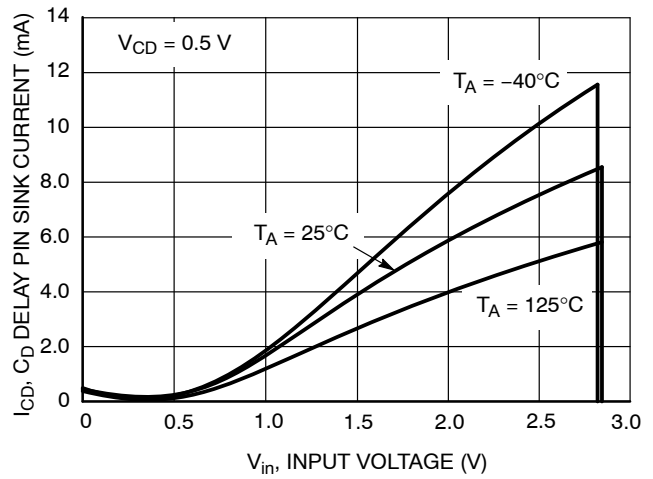


Figure 22. NCP302/3 Series 2.7 V
C_D Delay Pin Sink Current vs. Input Voltage

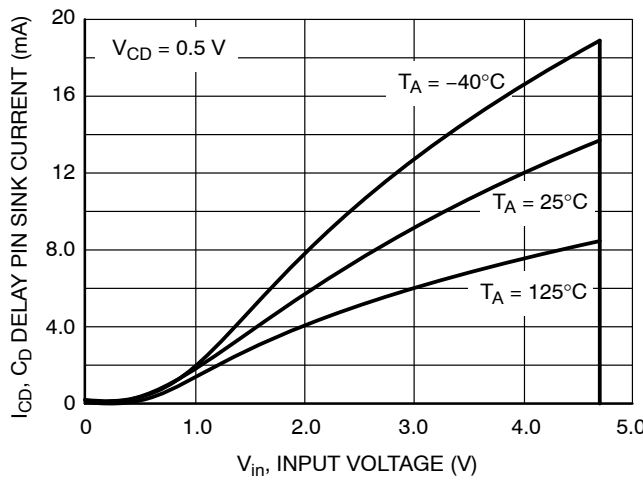


Figure 23. NCP302/3 Series 4.5 V
C_D Delay Pin Sink Current vs. Input Voltage

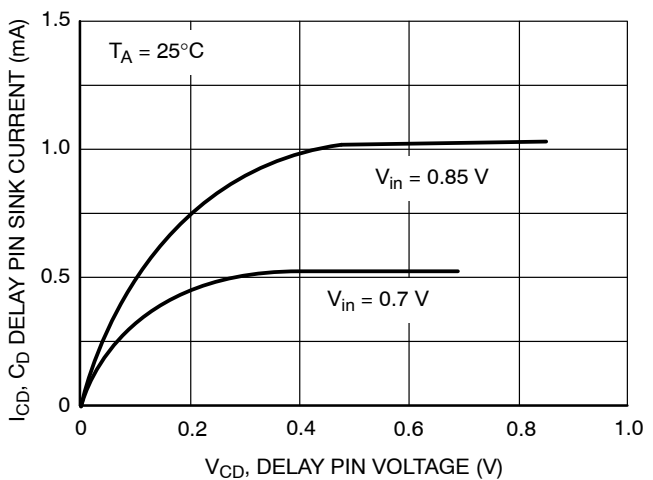


Figure 24. NCP302/3 Series 0.9 V
C_D Delay Pin Sink Current vs. Voltage

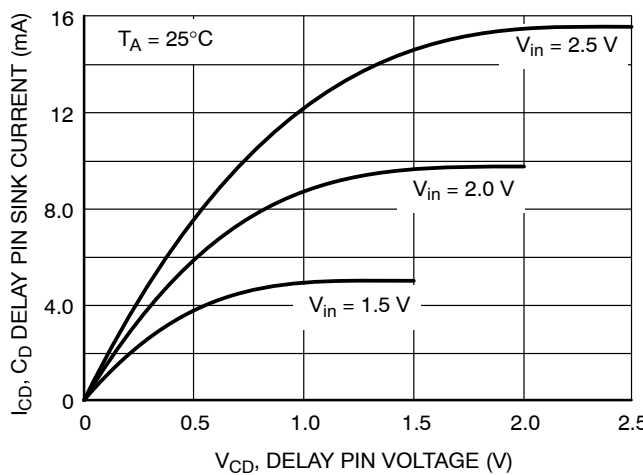


Figure 25. NCP302/3 Series 2.7 V
C_D Delay Pin Sink Current vs. Voltage

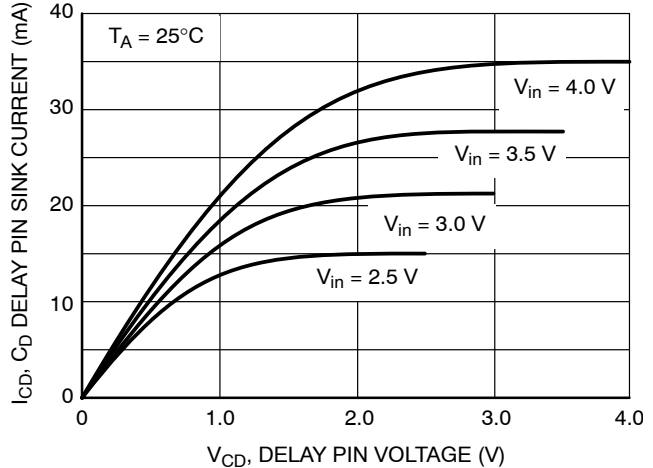
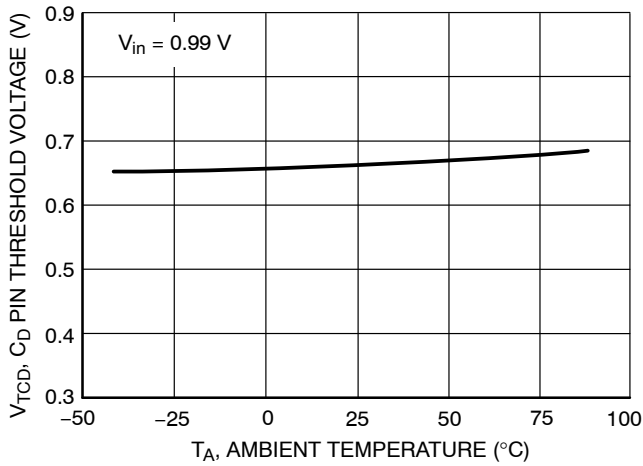
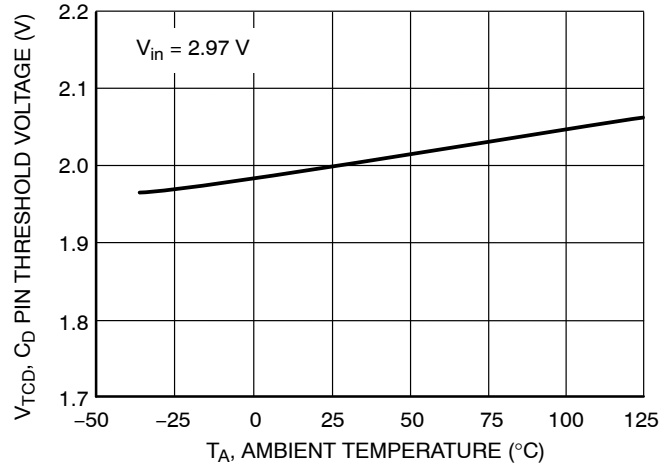


Figure 26. NCP302/3 Series 4.5 V
C_D Delay Pin Sink Current vs. Voltage

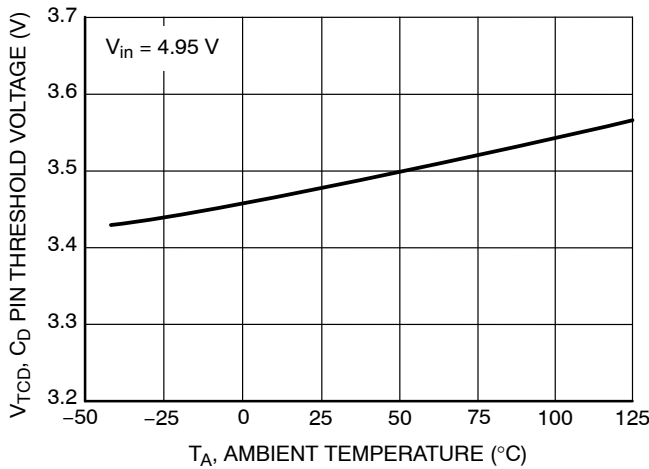
NCP302, NCP303



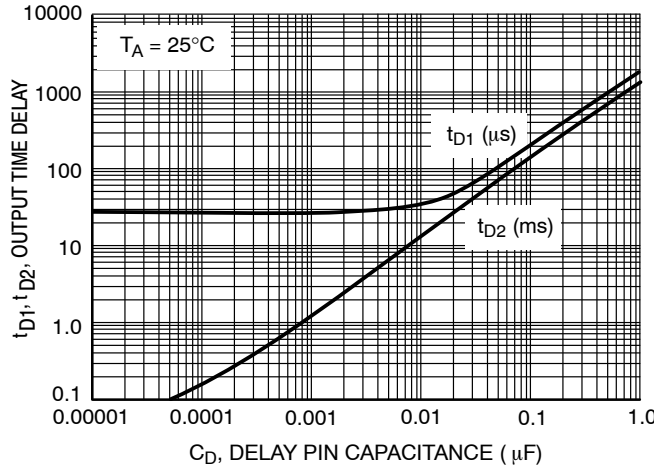
**Figure 27. NCP302/3 Series 0.9 V
C_D Delay Pin Threshold Voltage vs. Temperature**



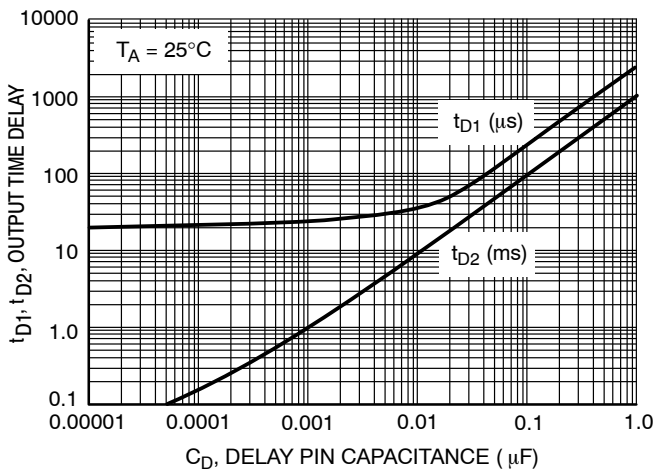
**Figure 28. NCP302/3 Series 2.7 V
C_D Delay Pin Threshold Voltage vs. Temperature**



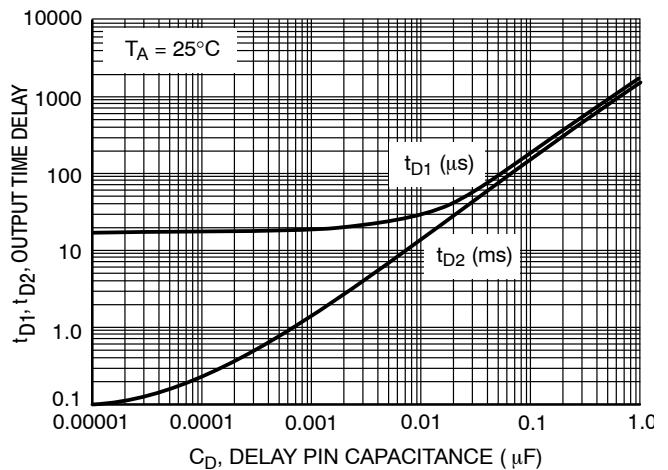
**Figure 29. NCP302/3 Series 4.5 V
C_D Delay Pin Threshold Voltage vs. Temperature**



**Figure 30. NCP302/3 Series 0.9 V
Output Time Delay vs. Capacitance**

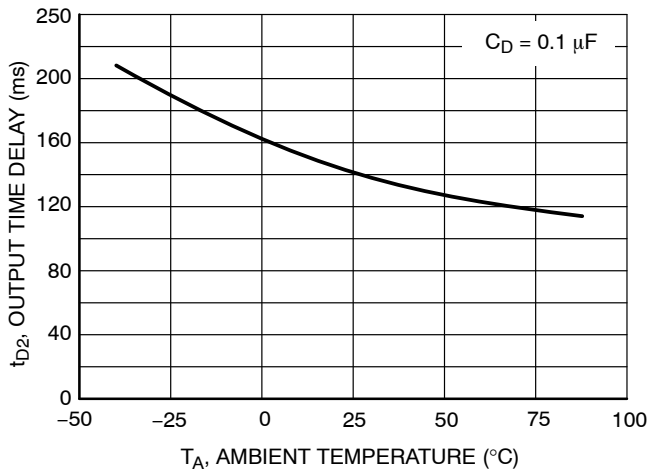


**Figure 31. NCP302/3 Series 2.7 V
Output Time Delay vs. Capacitance**

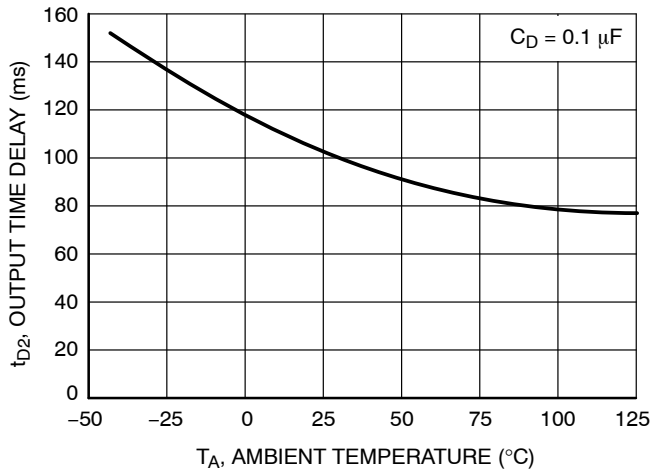


**Figure 32. NCP302/3 Series 4.5 V
Output Time Delay vs. Capacitance**

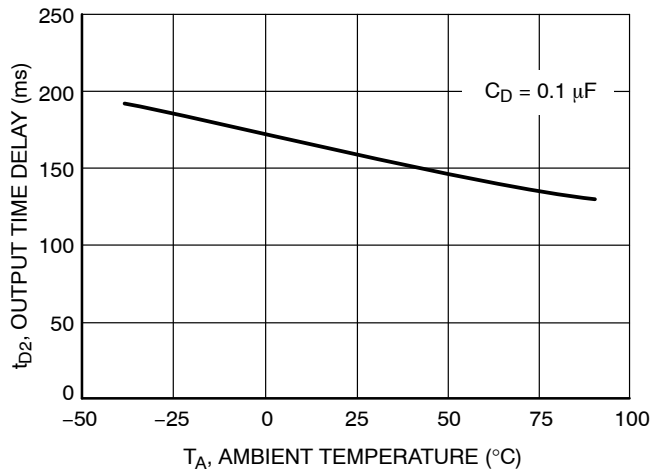
NCP302, NCP303



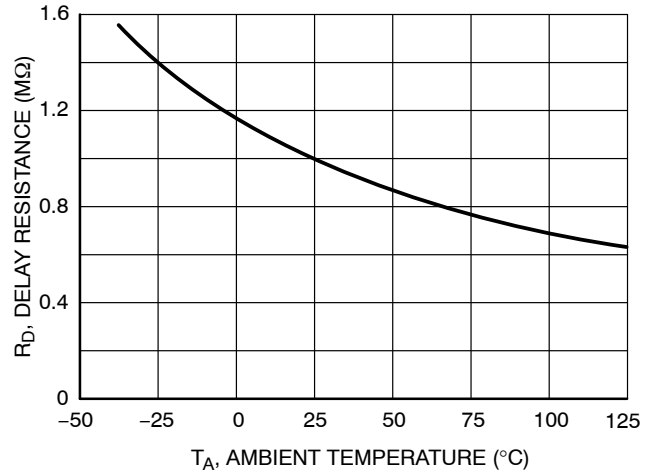
**Figure 33. NCP302/3 Series 0.9 V
Reset Output Time Delay vs. Temperature**



**Figure 34. NCP302/3 Series 2.7 V
Reset Output Time Delay vs. Temperature**



**Figure 35. NCP302/3 Series 4.5 V
Reset Output Time Delay vs. Temperature**



**Figure 36. NCP302/3 Series
Delay Resistance vs. Temperature**

OPERATING DESCRIPTION

The NCP302 and NCP303 series devices consist of a precision voltage detector that drives a time delay generator. Figures 37 and 38 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+}). The voltage at Pin 5 and capacitor C_D will be at the same level as V_{in} , 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-}) and the external time delay capacitor C_D will be immediately discharged by an internal N-Channel MOSFET that connects to Pin 5. 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 will turn off the N-Channel MOSFET and allow pullup resistor R_D to charge external capacitor C_D , thus creating a programmable delay for releasing the reset signal. When the voltage at Pin 5 exceeds the inverter/buffer threshold, typically $0.675 V_{in}$, the reset output will revert back to its original state. The reset output time delay versus capacitance is shown in Figures 30 through 32. The voltage detector and inverter/buffer have built-in hysteresis to prevent erratic reset operation.

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 and time delay are required. Figures 38 through 46 show various application examples.

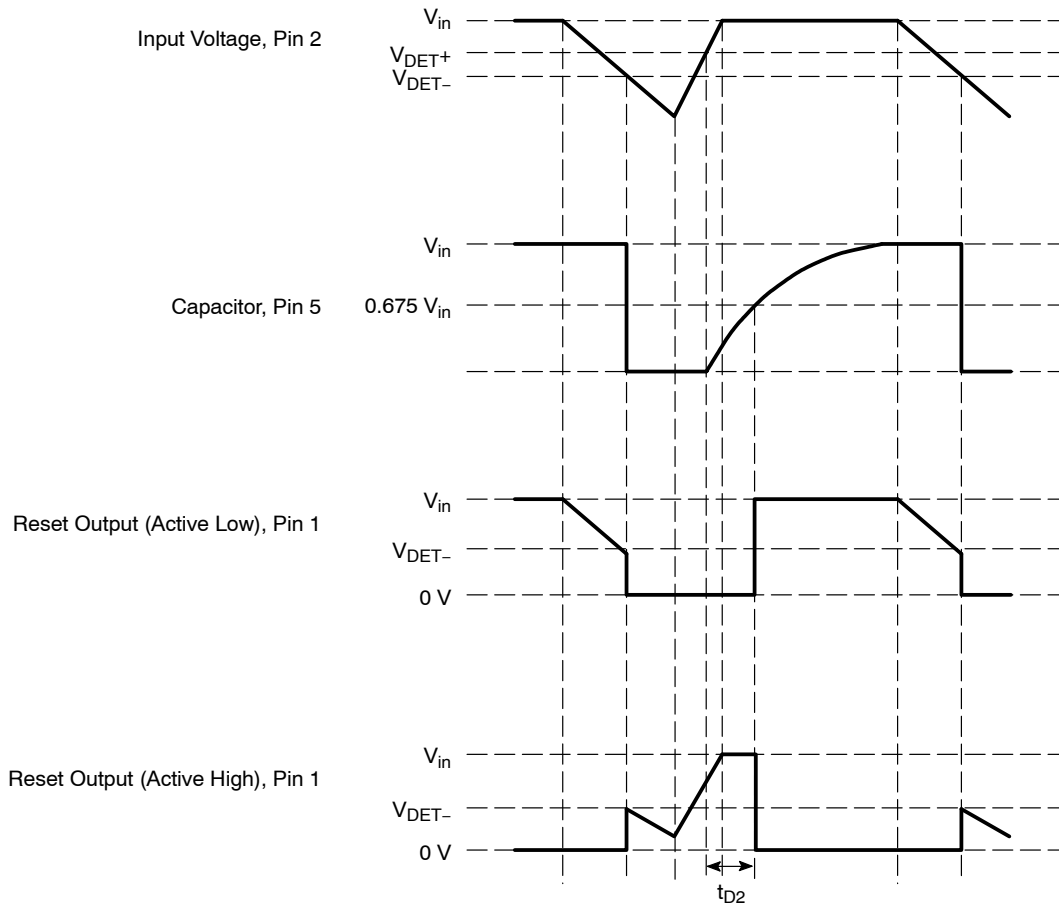


Figure 37. Timing Waveforms

NCP302, NCP303

APPLICATION CIRCUIT INFORMATION

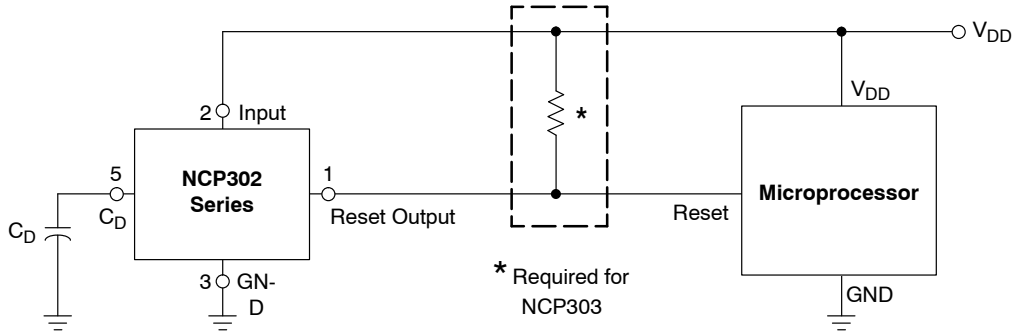


Figure 38. Microprocessor Reset Circuit

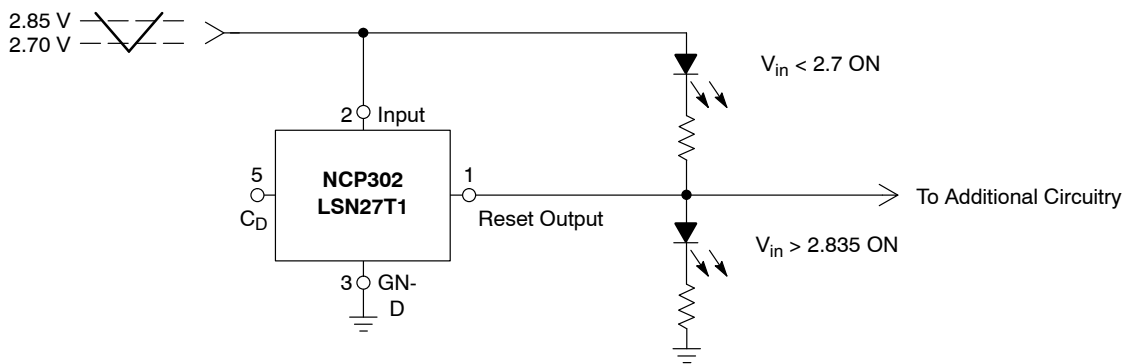


Figure 39. Battery Charge Indicator

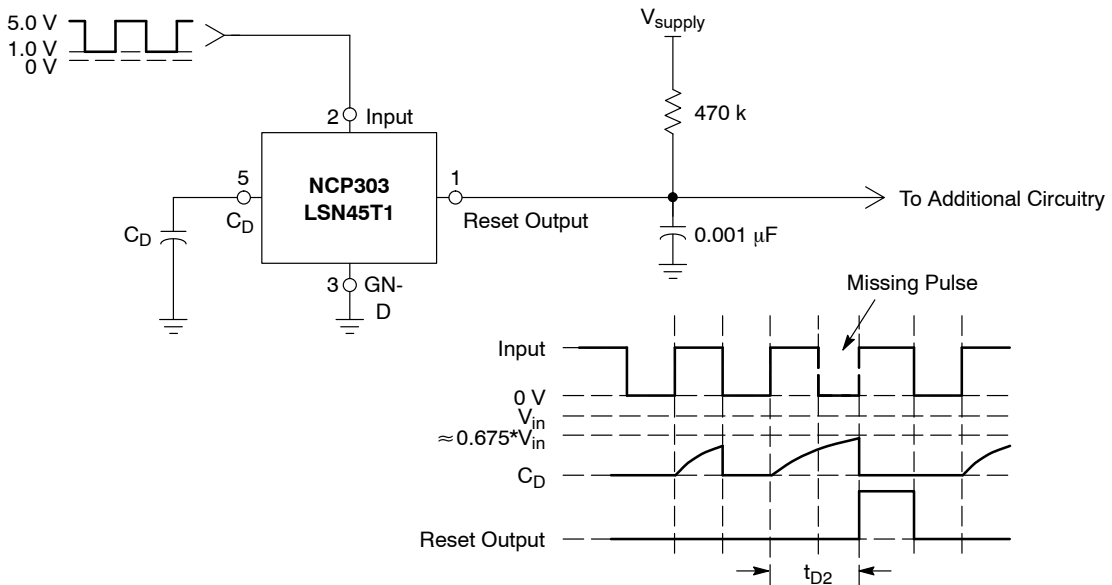


Figure 40. Missing Pulse Detector or Frequency Detector

NCP302, NCP303

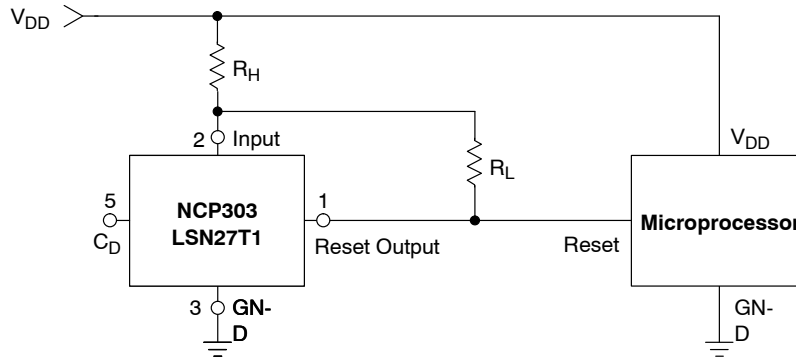


Figure 41. Microprocessor Reset Circuit with Additional Hysteresis

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:

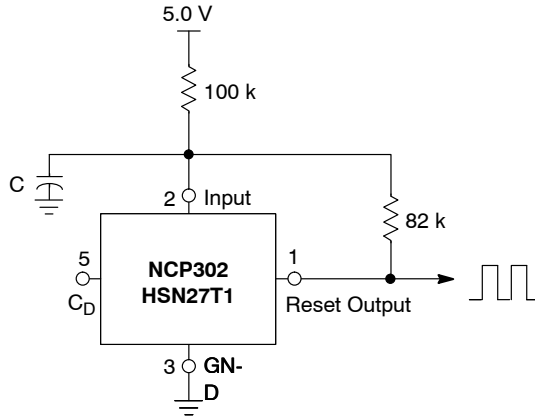
$$V_{th} = \left(\frac{R_H}{R_{in}} + 1 \right) (V_{DET-})$$

V_{in} Increasing:

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

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

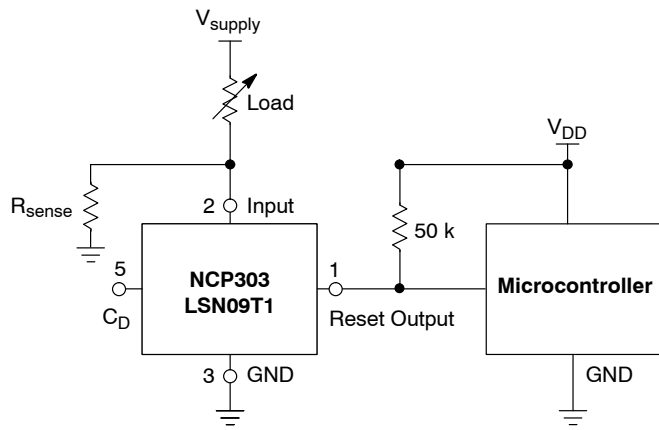
| Test Data | | | | |
|-------------------------|-------------------------|---------------|--------------------|---------------------|
| V_{th} Decreasing (V) | V_{th} Increasing (V) | V_{HYS} (V) | R_H (Ω) | R_L (k Ω) |
| 2.70 | 2.84 | 0.135 | 0 | - |
| 2.70 | 2.87 | 0.17 | 100 | 10 |
| 2.70 | 2.88 | 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 |



| 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 42. Simple Clock Oscillator

NCP302, NCP303

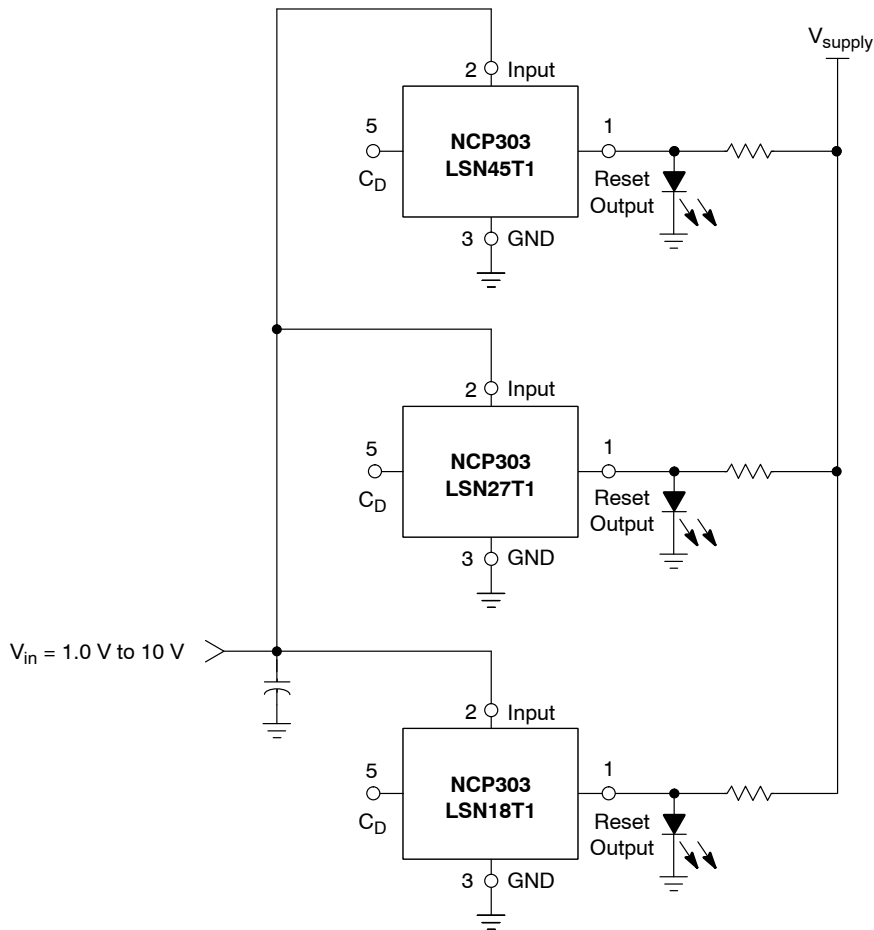


This circuit monitors the current at the load. As current flows through the load, a voltage drop with respect to ground appears across R_{sense} where $V_{sense} = I_{load} * R_{sense}$. The following conditions apply:

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

Then:
 Reset Output = 0 V
 Reset Output = V_{DD}

Figure 43. Microcontroller Systems Load Sensing



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 44. LED Bar Graph Voltage Monitor

NCP302, NCP303

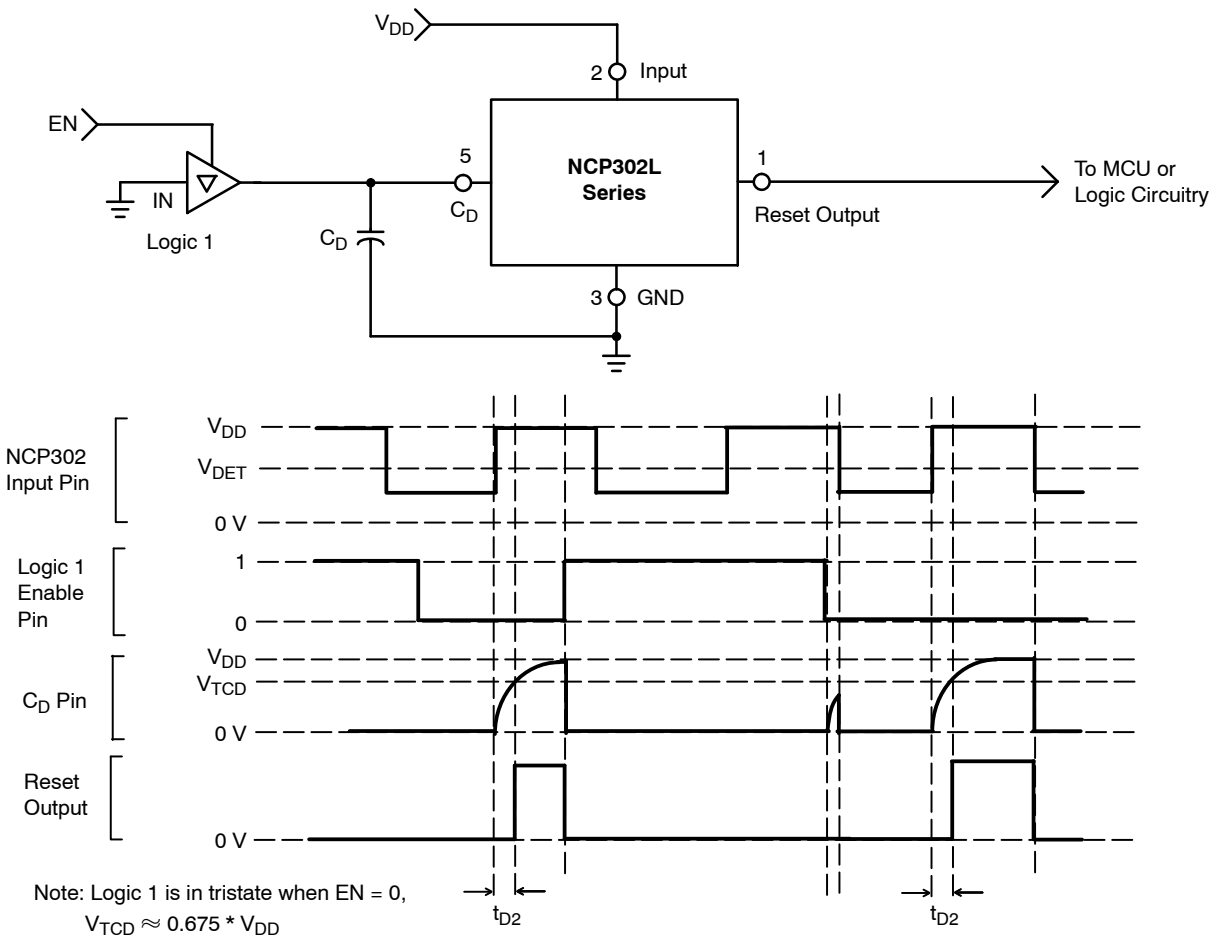


Figure 45. Undervoltage Detection with Independent Reset Signal Control

This circuit monitors V_{DD} for undervoltage. If the V_{DD} input falls below the detector threshold (V_{DET}), then the capacitor on the C_D pin will be immediately discharged resulting in the reset output changing to its active state indicating that an undervoltage event has been detected. The addition of a logic gate (Logic 1) provides for reset output control which is independent of V_{DD} . If the output of the

logic gate is tristated the undervoltage detector will behave normally. If the tristate is de-asserted, the logic gate will pull the C_D pin low resulting in the Reset Output pin changing to an active state. This independent control is useful in power supply sequencing applications when the Reset Output is tied to the enable input of an LDO or DC-DC converter.

NCP302, NCP303

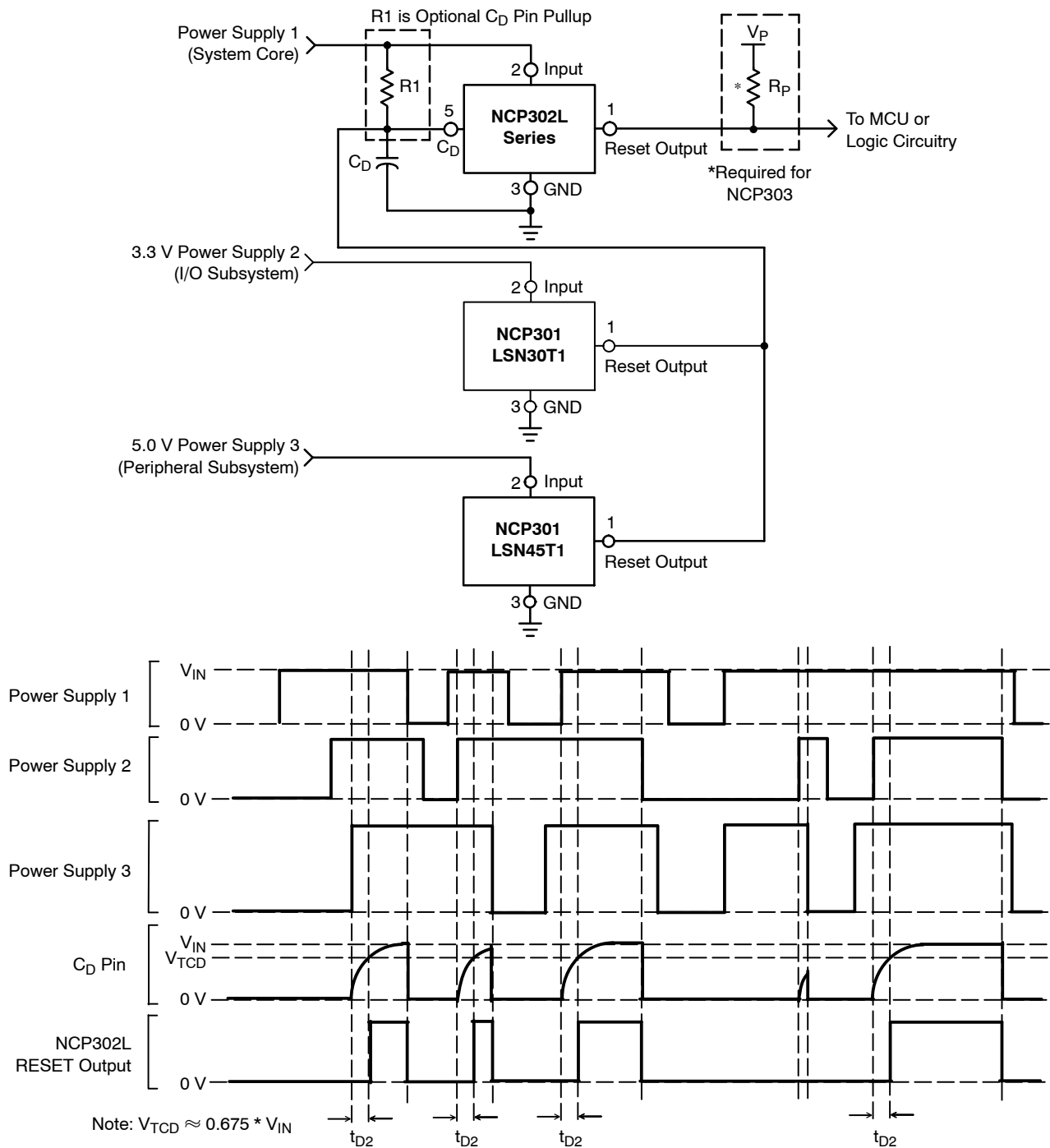


Figure 46. Multi-Rail Supply Undervoltage Monitor with Power Good

This circuit monitors multiple power supply rails for undervoltage conditions. If any of the three power supplies are in an undervoltage condition, the NCP302 reset output will be immediately set to an active low level. All three power supplies must be above their minimum voltage levels for the NCP302 reset output to generate a “Power Good” level (Reset Output = Power Supply 1 or V_P).

Optionally, R1 may be added to provide a smaller effective C_D pin pullup resistance, (R_D'), where $R_D' = R1 \parallel R_D$, with R_D (internal C_D pin pullup resistance)

approximately equal to 1.0 M Ω , and $R1 > 5 \text{ k}\Omega$. If $R1 \ll R_D$, then R1 also can decrease the reset output delay time (t_{D2}) variance over the operating temperature range.

The Power Good signal time delay (t_{D2}) can be estimated by: $t_{D2} \approx R_D * C_D$, with R_D in Ohms, and C_D in Farads. If R1 is installed, then R_D' is substituted for R_D . R_P is added only if using the NCP303 to replace the NCP302. This allows the Reset Output to be pulled up to V_P which can be the Power Supply 1 or an independent power supply rail.

NCP302, NCP303

ORDERING INFORMATION

| Device | Threshold Voltage | Output Type | Reset | Marking | Package | Shipping [†] |
|-----------------|-------------------|-------------|------------|---------|------------------|----------------------------------|
| NCV303LSN09T1G* | 0.9 | Open Drain | Active Low | AMU | TSOP-5 (Pb-Free) | 3000 / Tape & Reel (7 inch Reel) |
| NCV303LSN10T1G* | 1.0 | | | SSM | | |
| NCV303LSN11T1G* | 1.1 | | | ADC | | |
| NCV303LSN16T1G* | 1.6 | | | SRV | | |
| NCV303LSN20T1G* | 2.0 | | | SRW | | |
| NCV303LSN24T1G* | 2.4 | | | SRY | | |
| NCV303LSN25T1G* | 2.5 | | | AHA | | |
| NCV303LSN27T1G* | 2.7 | | | CAP | | |
| NCV303LSN29T1G* | 2.9 | | | SSK | | |
| NCV303LSN30T1G* | 3.0 | | | SSA | | |
| NCV303LSN31T1G* | 3.1 | | | CAR | | |
| NCV303LSN34T1G* | 3.4 | | | CAT | | |
| NCV303LSN40T1G* | 4.0 | | | SSD | | |
| NCV303LSN42T1G* | 4.2 | | | SSE | | |
| NCV303LSN44T1G* | 4.4 | | | SSF | | |
| NCV303LSN45T1G* | 4.5 | | | SSG | | |
| NCV303LSN46T1G* | 4.6 | SSH | | | | |

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 NCP302 active high output devices, ranging from 0.9 V to 4.9 V in 100 mV increments can be manufactured. Contact your **onsemi** representative for availability. The electrical characteristics of these additional devices are shown in Tables 1 and 2.

†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](#).

*NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

NCVxxx: T_{low} = -40°C, T_{high} = +125°C. Guaranteed by design.

NCP302, NCP303

DISCONTINUED (Note 21)

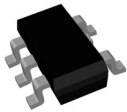
| Device | Threshold Voltage | Output Type | Reset | Marking | Package | Shipping [†] |
|-----------------|-------------------|-------------|-------------|---------|---------------------|-------------------------------------|
| NCP302LSN09T1G | 0.9 | CMOS | Active Low | SBO | TSOP-5 (Pb-Free) | 3000 / Tape & Reel (7 inch Reel) |
| NCP302LSN15T1G | 1.5 | | | SBI | | |
| NCP302LSN18T1G | 1.8 | | | SBF | | |
| NCP302LSN20T1G | 2.0 | | | SBD | | |
| NCV302LSN20T1G* | 2.0 | | | AHH | | |
| NCP302LSN27T1G | 2.7 | | | SAW | | |
| NCP302LSN28T1G | 2.8 | | | ALA | | |
| NCP302LSN30T1G | 3.0 | | | SAT | | |
| NCV302LSN30T1G* | 3.0 | | | ACJ | | |
| NCP302LSN33T1G | 3.3 | | | SAQ | | |
| NCP302LSN38T1G | 3.8 | | | SAK | | |
| NCP302LSN40T1G | 4.0 | | | SAI | | |
| NCP302LSN43T1G | 4.3 | | | SAF | | |
| NCP302LSN45T1G | 4.5 | | | SAL | | |
| NCP302LSN47T1G | 4.7 | | SAC | | | |
| NCP302HSN09T1G | 0.9 | | Active High | SDO | | |
| NCP302HSN18T1G | 1.8 | | | SFH | | |
| NCP302HSN27T1G | 2.7 | | | SDK | | |
| NCP302HSN30T1G | 3.0 | | | SDI | | |
| NCP302HSN40T1G | 4.0 | | | SJH | | |
| NCP302HSN45T1G | 4.5 | SDG | | | | |
| NCP303LSN09T1G | 0.9 | Open Drain | Active Low | SDE | TSOP-5 (Pb-Free) | |
| NCP303LSN10T1G | 1.0 | | | SDD | | |
| NCP303LSN11T1G | 1.1 | | | SDC | | |
| NCV303LSN12T1G* | 1.2 | | | SDB | | |
| NCP303LSN13T1G | 1.3 | | | SDA | | |
| NCV303LSN13T1G* | 1.3 | | | SRS | | |
| NCP303LSN14T1G | 1.4 | | | SCZ | | |
| NCV303LSN14T1G* | 1.4 | | | SRT | | |
| NCP303LSN15T1G | 1.5 | | | SCY | | |
| NCV303LSN15T1G* | 1.5 | | | SRU | | |
| NCP303LSN16T1G | 1.6 | | | SCX | | |
| NCP303LSN17T1G | 1.7 | | | SCW | | TSOP-5 |
| NCP303LSN18T1G | 1.8 | | | SCV | | TSOP-5 (Pb-Free) |
| NCP303LSN20T1G | 2.0 | | | SCT | | |
| NCP303LSN22T1G | 2.2 | | SCR | | | |
| NCV303LSN22T1G* | 2.2 | | ADD | | | |
| NCP303LSN23T1G | 2.3 | | SCQ | | | |
| NCV303LSN23T1G* | 2.3 | | SRX | | | |
| NCP303LSN24T1G | 2.4 | | SCP | | | |

NCP302, NCP303

DISCONTINUED (Note 21) (continued)

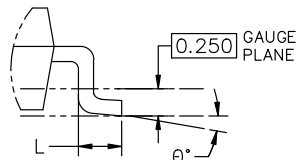
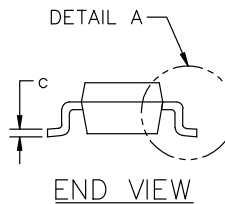
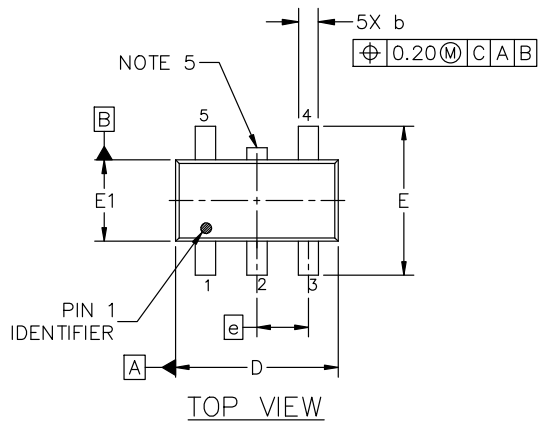
| Device | Threshold Voltage | Output Type | Reset | Marking | Package | Shipping† |
|-----------------|-------------------|-------------|------------|---------|------------------|----------------------------------|
| NCP303LSN25T1G | 2.5 | Open Drain | Active Low | SCO | TSOP-5 (Pb-Free) | 3000 / Tape & Reel (7 inch Reel) |
| NCP303LSN26T1G | 2.6 | | | SCN | | |
| NCP303LSN27T1G | 2.7 | | | SCM | | |
| NCP303LSN28T1G | 2.8 | | | SCL | | |
| NCV303LSN28T1G* | 2.8 | | | TAA | | |
| NCP303LSN29T1G | 2.9 | | | SCK | | |
| NCP303LSN30T1G | 3.0 | | | SCJ | | |
| NCP303LSN31T1G | 3.1 | | | SCI | | |
| NCP303LSN32T1G | 3.2 | | | SCH | | |
| NCP303LSN33T1G | 3.3 | | | SCG | | |
| NCP303LSN34T1G | 3.4 | | | SCF | | |
| NCP303LSN36T1G | 3.6 | | | SCD | | |
| NCV303LSN36T1G* | 3.6 | | | SSC | | |
| NCP303LSN38T1G | 3.8 | | | SCA | | |
| NCP303LSN40T1G | 4.0 | | | SBY | | |
| NCP303LSN42T1G | 4.2 | | | SBW | | |
| NCV303LSN43T1G* | 4.3 | | | SBV | | |
| NCP303LSN44T1G | 4.4 | | | SBU | | |
| NCV303LSN44T1* | 4.4 | | | SSF | TSOP-5 | |
| NCP303LSN45T1G | 4.5 | | | SBT | TSOP-5 (Pb-Free) | |
| NCP303LSN46T1G | 4.6 | | | SBS | TSOP-5 | |
| NCV303LSN46T1* | 4.6 | | | SSH | | |
| NCP303LSN47T1G | 4.7 | | | SBR | TSOP-5 (Pb-Free) | |
| NCV303LSN47T1* | 4.7 | | | SSJ | TSOP-5 | |
| NCV303LSN47T1G* | 4.7 | | | SSJ | TSOP-5 (Pb-Free) | |
| NCP303LSN49T1G | 4.9 | | | SBP | TSOP-5 | |
| NCV303LSN49T1* | 4.9 | | | SSI | | |
| NCV303LSN49T1G* | 4.9 | | | SSI | | |

21. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on www.onsemi.com.



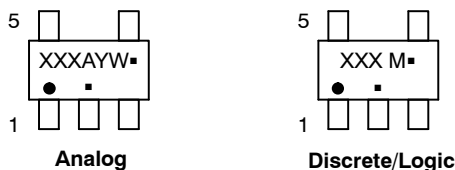
TSOP-5 3.00x1.50x0.95, 0.95P
CASE 483
ISSUE P

DATE 01 APR 2024



DETAIL "A"
SCALE 2:1

GENERIC
MARKING DIAGRAM*



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

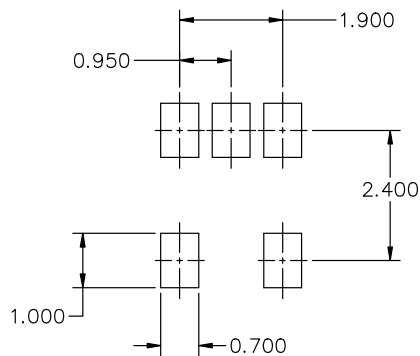
(Note: Microdot may be in either location)

*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. Some products may not follow the Generic Marking.

NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS (ANGLES IN DEGREES).
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OF GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION D.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

| DIM | MILLIMETERS | | |
|-----|-------------|-------|-------|
| | MIN. | NOM. | MAX. |
| A | 0.900 | 1.000 | 1.100 |
| A1 | 0.010 | 0.055 | 0.100 |
| A2 | 0.950 REF. | | |
| b | 0.250 | 0.375 | 0.500 |
| c | 0.100 | 0.180 | 0.260 |
| D | 2.850 | 3.000 | 3.150 |
| E | 2.500 | 2.750 | 3.000 |
| E1 | 1.350 | 1.500 | 1.650 |
| e | 0.950 BSC | | |
| L | 0.200 | 0.400 | 0.600 |
| θ | 0° | 5° | 10° |



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