

# NCP302, NCP303

## Voltage Detector Series with Programmable Delay

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  $\mu$ 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
- Pb-Free Packages are Available

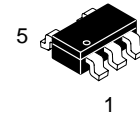
### Typical Applications

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



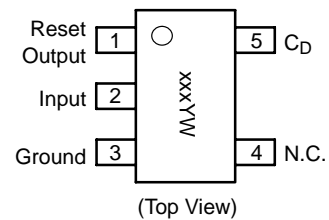
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**THIN SOT23-5/TSOP-5/SC59-5  
CASE 483**

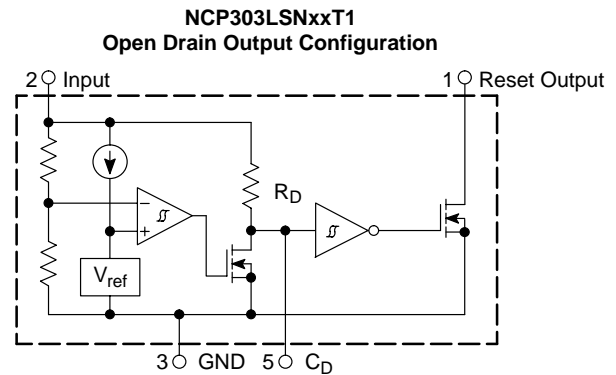
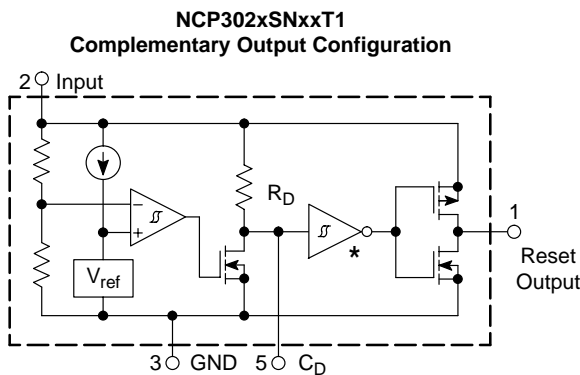
### PIN CONNECTIONS AND MARKING DIAGRAM



xxx = Specific Device Code  
Y = Year  
W = Work Week

### ORDERING INFORMATION

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



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

This device contains 28 active transistors.

**Figure 1. Representative Block Diagrams**

## NCP302, NCP303

### 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	°C/W
Maximum Junction Temperature	$T_J$	+125	°C
Operating Ambient Temperature Range	$T_A$	-40 to +85	°C
Storage Temperature Range	$T_{stg}$	-55 to +150	°C
Moisture Sensitivity Level ( $T_A = 235^\circ\text{C}$ )	MSL	1	
Latchup Performance Positive Negative	$I_{LATCHUP}$	200 200	mA

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

- 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.

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

# NCP302, NCP303

## ELECTRICAL CHARACTERISTICS (For all values $T_A = 25^\circ\text{C}$ , unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>NCP302/3 – 0.9</b>					
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	$\mu\text{A}$
Maximum Operating Voltage (Pin 2)	$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage (Pin 2) ( $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ )	$V_{in(min)}$	– –	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	– –	$\mu\text{A}$
Delay Pullup Resistance (Pin 5)	$R_D$	0.5	1.0	2.0	$\text{M}\Omega$
<b>NCP302/3 – 1.8</b>					
Detector Threshold (Pin 2, $V_{in}$ Decreasing)	$V_{DET-}$	1.764	1.80	1.836	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	$\mu\text{A}$
Maximum Operating Voltage (Pin 2)	$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage (Pin 2) ( $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ )	$V_{in(min)}$	– –	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

## NCP302, NCP303

**ELECTRICAL CHARACTERISTICS (continued)** (For all values  $T_A = 25^\circ\text{C}$ , unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>NCP302/3 – 1.8</b>					
$C_D$ Delay Pin Threshold Voltage (Pin 5) ( $V_{in} = 1.98\text{ V}$ )	$V_{TCD}$	0.99	1.34	1.68	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	– –	$\mu\text{A}$
Delay Pullup Resistance (Pin 5)	$R_D$	0.5	1.0	2.0	$\text{M}\Omega$
<b>NCP302/3 – 2.0</b>					
Detector Threshold (Pin 2, $V_{in}$ Decreasing)	$V_{DET-}$	1.960	2.00	2.040	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	$\mu\text{A}$
Maximum Operating Voltage (Pin 2)	$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage (Pin 2) ( $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ )	$V_{in(min)}$	– –	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	– –  –	$\text{mA}$
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	–  – –	$\text{mA}$
$C_D$ 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	120 1600	– –	$\mu\text{A}$
Delay Pullup Resistance (Pin 5)	$R_D$	0.5	1.0	2.0	$\text{M}\Omega$
<b>NCP302/3– 2.7</b>					
Detector Threshold (Pin 2, $V_{in}$ Decreasing)	$V_{DET-}$	2.646	2.700	2.754	V
Detector Threshold Hysteresis (Pin 2, $V_{in}$ Increasing)	$V_{HYS}$	0.081	0.135	0.189	V
Supply Current (Pin 2) ( $V_{in} = 2.6\text{ V}$ ) ( $V_{in} = 4.7\text{ V}$ )	$I_{in}$	– –	0.26 0.46	0.8 1.3	$\mu\text{A}$
Maximum Operating Voltage (Pin 2)	$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage (Pin 2) ( $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ )	$V_{in(min)}$	– –	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	– –  –	$\text{mA}$

## NCP302, NCP303

**ELECTRICAL CHARACTERISTICS (continued)** (For all values  $T_A = 25^\circ\text{C}$ , unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>NCP302/3– 2.7</b>					
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) ( $V_{in} = 2.97\text{ V}$ )	$V_{TCD}$	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	120 1600	– –	$\mu\text{A}$
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)	$V_{DET-}$	2.94	3.00	3.06	V
Detector Threshold Hysteresis (Pin 2, $V_{in}$ Increasing)	$V_{HYS}$	0.09	0.15	0.21	V
Supply Current (Pin 2) ( $V_{in} = 2.87\text{ V}$ ) ( $V_{in} = 5.0\text{ V}$ )	$I_{in}$	– –	0.27 0.47	0.9 1.3	$\mu\text{A}$
Maximum Operating Voltage (Pin 2)	$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage (Pin 2) ( $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ )	$V_{in(min)}$	– –	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) ( $V_{in} = 3.3\text{ V}$ )	$V_{TCD}$	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	120 1600	– –	$\mu\text{A}$
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)	$V_{DET-}$	4.410	4.500	4.590	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	$\mu\text{A}$
Maximum Operating Voltage (Pin 2)	$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage (Pin 2) ( $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ )	$V_{in(min)}$	– –	0.55 0.65	0.70 0.80	V

## NCP302, NCP303

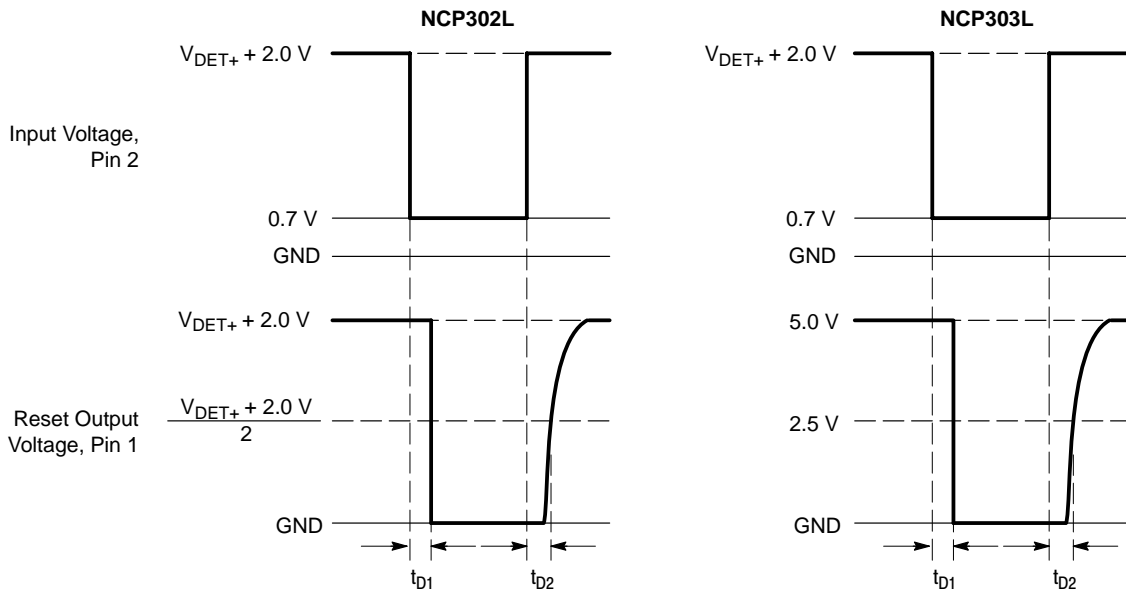
**ELECTRICAL CHARACTERISTICS (continued)** (For all values  $T_A = 25^\circ\text{C}$ , unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>NCP302/3 – 4.5</b>					
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 ( $V_{OUT} = 5.9\text{V}$ , $V_{in} = 8.0\text{V}$ )	$I_{OUT}$	0.01 1.0	0.05 2.0	– –	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) ( $V_{in} = 4.95\text{ V}$ )	$V_{TCD}$	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	– –	$\mu\text{A}$
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)	$V_{DET-}$	4.606	4.70	4.794	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	$\mu\text{A}$
Maximum Operating Voltage (Pin 2)	$V_{in(max)}$	–	–	10	V
Minimum Operating Voltage (Pin 2) ( $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ )	$V_{in(min)}$	– –	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 ( $V_{OUT} = 5.9\text{V}$ , $V_{in} = 8.0\text{V}$ )	$I_{OUT}$	0.01 1.0	0.05 2.0	– –	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) ( $V_{in} = 5.17\text{ V}$ )	$V_{TCD}$	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	– –	$\mu\text{A}$
Delay Pullup Resistance (Pin 5)	$R_D$	0.5	1.0	2.0	$\text{M}\Omega$

# 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 12, 13, and 14. 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 <sub>in</sub> Low	V <sub>in</sub> High	V <sub>in</sub> Low	V <sub>in</sub> High				
Part Number	V <sub>DET-</sub> (V)			V <sub>HYS</sub> (V)			I <sub>in</sub> (μA) (1)	I <sub>in</sub> (μA) (2)	I <sub>OUT</sub> (mA) (3)	I <sub>OUT</sub> (mA) (4)	I <sub>OUT</sub> (mA) (5)			
	Min	Typ	Max	Min	Typ	Max	Typ	Typ	Typ	Typ	Typ			
NCP302LSN09T1	0.882	0.9	0.918	0.027	0.045	0.063	0.3	0.5	0.05	0.5	2.0			
NCP302LSN10T1	0.980	1.0	1.020	0.030	0.050	0.070				1.0				
NCP302LSN11T1	1.078	1.1	1.122	0.033	0.055	0.077				2.0				
NCP302LSN12T1	1.176	1.2	1.224	0.036	0.060	0.084								
NCP302LSN13T1	1.274	1.3	1.326	0.039	0.065	0.091								
NCP302LSN14T1	1.372	1.4	1.428	0.042	0.070	0.098								
NCP302LSN15T1	1.470	1.5	1.530	0.045	0.075	0.105								
NCP302LSN16T1	1.568	1.6	1.632	0.048	0.080	0.112								
NCP302LSN17T1	1.666	1.7	1.734	0.051	0.085	0.119								
NCP302LSN18T1	1.764	1.8	1.836	0.054	0.090	0.126								
NCP302LSN19T1	1.862	1.9	1.938	0.057	0.095	0.133								
NCP302LSN20T1	1.960	2.0	2.040	0.060	0.100	0.140								
NCP302LSN21T1	2.058	2.1	2.142	0.063	0.105	0.147								
NCP302LSN22T1	2.156	2.2	2.244	0.066	0.110	0.154								
NCP302LSN23T1	2.254	2.3	2.346	0.069	0.115	0.161								
NCP302LSN24T1	2.352	2.4	2.448	0.072	0.120	0.168								
NCP302LSN25T1	2.450	2.5	2.550	0.075	0.125	0.175								
NCP302LSN26T1	2.548	2.6	2.652	0.078	0.130	0.182								
NCP302LSN27T1	2.646	2.7	2.754	0.081	0.135	0.189								
NCP302LSN28T1	2.744	2.8	2.856	0.084	0.140	0.196								
NCP302LSN29T1	2.842	2.9	2.958	0.087	0.145	0.203								
NCP302LSN30T1	2.940	3.0	3.060	0.090	0.150	0.210								
NCP302LSN31T1	3.038	3.1	3.162	0.093	0.155	0.217								
NCP302LSN32T1	3.136	3.2	3.264	0.096	0.160	0.224								
NCP302LSN33T1	3.234	3.3	3.366	0.099	0.165	0.231								
NCP302LSN34T1	3.332	3.4	3.468	0.102	0.170	0.238								
NCP302LSN35T1	3.430	3.5	3.570	0.105	0.175	0.245								
NCP302LSN36T1	3.528	3.6	3.672	0.108	0.180	0.252								
NCP302LSN37T1	3.626	3.7	3.774	0.111	0.185	0.259								
NCP302LSN38T1	3.724	3.8	3.876	0.114	0.190	0.266								
NCP302LSN39T1	3.822	3.9	3.978	0.117	0.195	0.273								
NCP302LSN40T1	3.920	4.0	4.080	0.120	0.200	0.280				0.4		0.6		3.0
NCP302LSN41T1	4.018	4.1	4.182	0.123	0.205	0.287								
NCP302LSN42T1	4.116	4.2	4.284	0.126	0.210	0.294								
NCP302LSN43T1	4.214	4.3	4.386	0.129	0.215	0.301								
NCP302LSN44T1	4.312	4.4	4.488	0.132	0.220	0.308								
NCP302LSN45T1	4.410	4.5	4.590	0.135	0.225	0.315								
NCP302LSN46T1	4.508	4.6	4.692	0.138	0.230	0.322								
NCP302LSN47T1	4.606	4.7	4.794	0.141	0.235	0.329								
NCP302LSN48T1	4.704	4.8	4.896	0.144	0.240	0.336								
NCP302LSN49T1	4.802	4.9	4.998	0.147	0.245	0.343								

3. Condition 1: 0.9 – 2.9 V, V<sub>in</sub> = V<sub>DET-</sub> – 0.10 V; 3.0 – 3.9 V, V<sub>in</sub> = V<sub>DET-</sub> – 0.13 V; 4.0 – 4.9 V, V<sub>in</sub> = V<sub>DET-</sub> – 0.16 V
4. Condition 2: 0.9 – 4.9 V, V<sub>in</sub> = V<sub>DET-</sub> + 2.0 V
5. Condition 3: 0.9 – 4.9 V, V<sub>in</sub> = 0.7 V, V<sub>OUT</sub> = 0.05 V, Active Low 'L' Suffix Devices
6. Condition 4: 0.9 – 1.0 V, V<sub>in</sub> = 0.85 V, V<sub>OUT</sub> = 0.5 V; 1.1 – 1.5 V, V<sub>in</sub> = 1.0 V, V<sub>OUT</sub> = 0.5 V; 1.6 – 4.9 V, V<sub>in</sub> = 1.5 V, V<sub>OUT</sub> = 0.5 V, Active Low 'L' Suffix Devices
7. Condition 5: 0.9 – 3.9 V, V<sub>in</sub> = 4.5 V, V<sub>OUT</sub> = 2.4 V; 4.0 – 4.9 V, V<sub>in</sub> = 8.0 V, V<sub>OUT</sub> = 5.9 V, Active Low 'L' Suffix Devices



## NCP302, NCP303

**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 <sub>in</sub> Low	V <sub>in</sub> High		V <sub>in</sub> Low	V <sub>in</sub> High
Part Number	V <sub>DET-</sub> (V)			V <sub>HYS</sub> (V)			I <sub>in</sub> (μA) (1)	I <sub>in</sub> (μA) (2)	I <sub>OUT</sub> (mA) (3)	I <sub>OUT</sub> (mA) (4)	I <sub>OUT</sub> (mA) (5)
	Min	Typ	Max	Min	Typ	Max	Typ	Typ	Typ	Typ	Typ
NCP302HSN09T1	0.882	0.9	0.918	0.027	0.045	0.063	0.3	0.5	2.5	0.04	0.08
NCP302HSN10T1	0.980	1.0	1.020	0.030	0.050	0.070					
NCP302HSN11T1	1.078	1.1	1.122	0.033	0.055	0.077					
NCP302HSN12T1	1.176	1.2	1.224	0.036	0.060	0.084					
NCP302HSN13T1	1.274	1.3	1.326	0.039	0.065	0.091					
NCP302HSN14T1	1.372	1.4	1.428	0.042	0.070	0.098					
NCP302HSN15T1	1.470	1.5	1.530	0.045	0.075	0.105					
NCP302HSN16T1	1.568	1.6	1.632	0.048	0.080	0.112					
NCP302HSN17T1	1.666	1.7	1.734	0.051	0.085	0.119					
NCP302HSN18T1	1.764	1.8	1.836	0.054	0.090	0.126					
NCP302HSN19T1	1.862	1.9	1.938	0.057	0.095	0.133					
NCP302HSN20T1	1.960	2.0	2.040	0.060	0.100	0.140					
NCP302HSN21T1	2.058	2.1	2.142	0.063	0.105	0.147					
NCP302HSN22T1	2.156	2.2	2.244	0.066	0.110	0.154					
NCP302HSN23T1	2.254	2.3	2.346	0.069	0.115	0.161					
NCP302HSN24T1	2.352	2.4	2.448	0.072	0.120	0.168					
NCP302HSN25T1	2.450	2.5	2.550	0.075	0.125	0.175					
NCP302HSN26T1	2.548	2.6	2.652	0.078	0.130	0.182					
NCP302HSN27T1	2.646	2.7	2.754	0.081	0.135	0.189					
NCP302HSN28T1	2.744	2.8	2.856	0.084	0.140	0.196					
NCP302HSN29T1	2.842	2.9	2.958	0.087	0.145	0.203					
NCP302HSN30T1	2.940	3.0	3.060	0.090	0.150	0.210					
NCP302HSN31T1	3.038	3.1	3.162	0.093	0.155	0.217					
NCP302HSN32T1	3.136	3.2	3.264	0.096	0.160	0.224					
NCP302HSN33T1	3.234	3.3	3.366	0.099	0.165	0.231					
NCP302HSN34T1	3.332	3.4	3.468	0.102	0.170	0.238					
NCP302HSN35T1	3.430	3.5	3.570	0.105	0.175	0.245					
NCP302HSN36T1	3.528	3.6	3.672	0.108	0.180	0.252					
NCP302HSN37T1	3.626	3.7	3.774	0.111	0.185	0.259					
NCP302HSN38T1	3.724	3.8	3.876	0.114	0.190	0.266					
NCP302HSN39T1	3.822	3.9	3.978	0.117	0.195	0.273					
NCP302HSN40T1	3.920	4.0	4.080	0.120	0.200	0.280					
NCP302HSN41T1	4.018	4.1	4.182	0.123	0.205	0.287					
NCP302HSN42T1	4.116	4.2	4.284	0.126	0.210	0.294					
NCP302HSN43T1	4.214	4.3	4.386	0.129	0.215	0.301					
NCP302HSN44T1	4.312	4.4	4.488	0.132	0.220	0.308					
NCP302HSN45T1	4.410	4.5	4.590	0.135	0.225	0.315					
NCP302HSN46T1	4.508	4.6	4.692	0.138	0.230	0.322					
NCP302HSN47T1	4.606	4.7	4.794	0.141	0.235	0.329					
NCP302HSN48T1	4.704	4.8	4.896	0.144	0.240	0.336					
NCP302HSN49T1	4.802	4.9	4.998	0.147	0.245	0.343					

8. Condition 1: 0.9 – 2.9 V, V<sub>in</sub> = V<sub>DET-</sub> – 0.10 V; 3.0 – 3.9 V, V<sub>in</sub> = V<sub>DET-</sub> – 0.13 V; 4.0 – 4.9 V, V<sub>in</sub> = V<sub>DET-</sub> – 0.16 V  
 9. Condition 2: 0.9 – 4.9 V, V<sub>in</sub> = V<sub>DET-</sub> + 2.0 V  
 10. Condition 3: 0.9 – 1.4 V, V<sub>in</sub> = 1.5 V, V<sub>OUT</sub> = 0.5 V; 1.5 – 4.9 V, V<sub>in</sub> = 5.0 V, V<sub>OUT</sub> = 0.5 V, Active High 'H' Suffix Devices  
 11. Condition 4: 0.9 – 4.9 V, V<sub>in</sub> = 0.7 V, V<sub>OUT</sub> = 0.4 V, Active High 'H' Suffix Devices  
 12. Condition 5: 0.9 – 1.0 V, V<sub>in</sub> = 0.8 V, V<sub>OUT</sub> = GND; 1.1 – 1.5 V, V<sub>in</sub> = 1.0 V, V<sub>OUT</sub> = GND; 1.6 – 4.9 V, V<sub>in</sub> = 1.5 V, V<sub>OUT</sub> = 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 <sub>in</sub> Low	V <sub>in</sub> High	V <sub>in</sub> Low	V <sub>in</sub> High	
Part Number	V <sub>DET-</sub> (V)			V <sub>HYS</sub> (V)			I <sub>in</sub> (μA) (1)	I <sub>in</sub> (μA) (2)	I <sub>OUT</sub> (mA) (3)	I <sub>OUT</sub> (mA) (4)	
	Min	Typ	Max	Min	Typ	Max	Typ	Typ	Typ	Typ	
NCP303LSN09T1	0.882	0.9	0.918	0.027	0.045	0.063	0.3	0.5	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					
NCP303LSN12T1	1.176	1.2	1.224	0.036	0.060	0.084					
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					
NCP303LSN19T1	1.862	1.9	1.938	0.057	0.095	0.133					
NCP303LSN20T1	1.960	2.0	2.040	0.060	0.100	0.140					
NCP303LSN21T1	2.058	2.1	2.142	0.063	0.105	0.147					
NCP303LSN22T1	2.156	2.2	2.244	0.066	0.110	0.154					
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					
NCP303LSN34T1	3.332	3.4	3.468	0.102	0.170	0.238					
NCP303LSN35T1	3.430	3.5	3.570	0.105	0.175	0.245					
NCP303LSN36T1	3.528	3.6	3.672	0.108	0.180	0.252					
NCP303LSN37T1	3.626	3.7	3.774	0.111	0.185	0.259					
NCP303LSN38T1	3.724	3.8	3.876	0.114	0.190	0.266					
NCP303LSN39T1	3.822	3.9	3.978	0.117	0.195	0.273					
NCP303LSN40T1	3.920	4.0	4.080	0.120	0.200	0.280	0.4	0.6			
NCP303LSN41T1	4.018	4.1	4.182	0.123	0.205	0.287					
NCP303LSN42T1	4.116	4.2	4.284	0.126	0.210	0.294					
NCP303LSN43T1	4.214	4.3	4.386	0.129	0.215	0.301					
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					
NCP303LSN47T1	4.606	4.7	4.794	0.141	0.235	0.329					
NCP303LSN48T1	4.704	4.8	4.896	0.144	0.240	0.336					
NCP303LSN49T1	4.802	4.9	4.998	0.147	0.245	0.343					

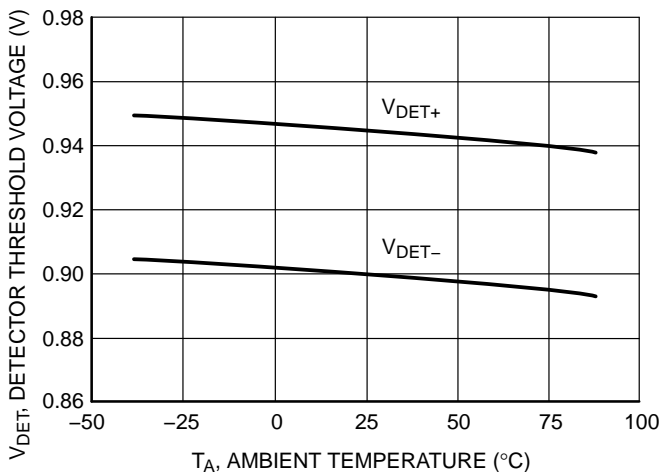
13. Condition 1: 0.9 — 2.9 V, V<sub>in</sub> = V<sub>DET-</sub> - 0.10 V; 3.0 — 3.9 V, V<sub>in</sub> = V<sub>DET-</sub> - 0.13 V; 4.0 — 4.9 V, V<sub>in</sub> = V<sub>DET-</sub> - 0.16 V

14. Condition 2: 0.9 — 4.9 V, V<sub>in</sub> = V<sub>DET-</sub> + 2.0 V

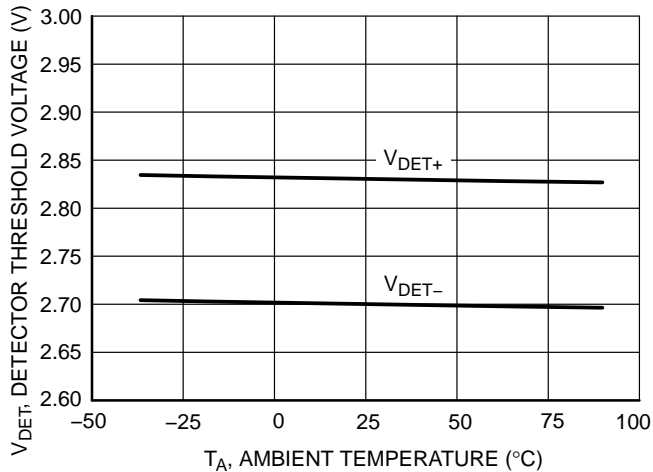
15. Condition 3: 0.9 — 4.9 V, V<sub>in</sub> = 0.7 V, V<sub>OUT</sub> = 0.05 V, Active Low 'L' Suffix Devices

16. Condition 4: 0.9 — 1.0 V, V<sub>in</sub> = 0.85 V, V<sub>OUT</sub> = 0.5 V; 1.1 — 1.5 V, V<sub>in</sub> = 1.0 V, V<sub>OUT</sub> = 0.5 V; 1.6 — 4.9 V, V<sub>in</sub> = 1.5 V, V<sub>OUT</sub> = 0.5 V, Active Low 'L' Suffix Devices

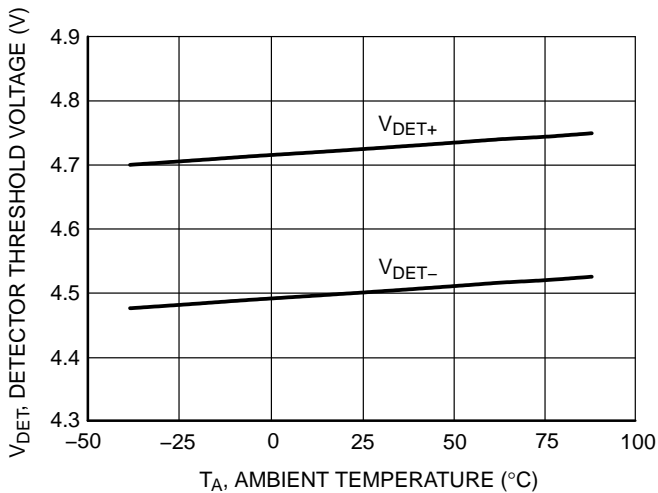
# NCP302, NCP303



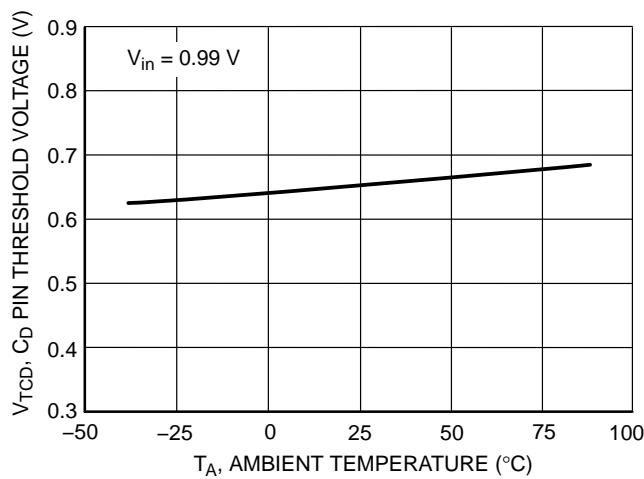
**Figure 3. NCP302/3 Series 0.9 V  
Detector Threshold Voltage vs. Temperature**



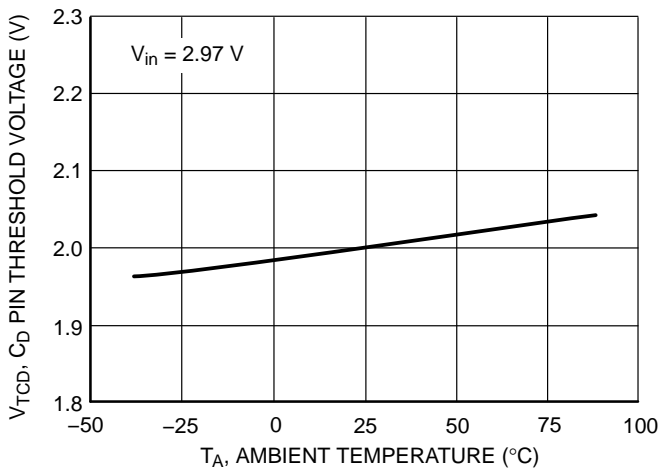
**Figure 4. NCP302/3 Series 2.7 V  
Detector Threshold Voltage vs. Temperature**



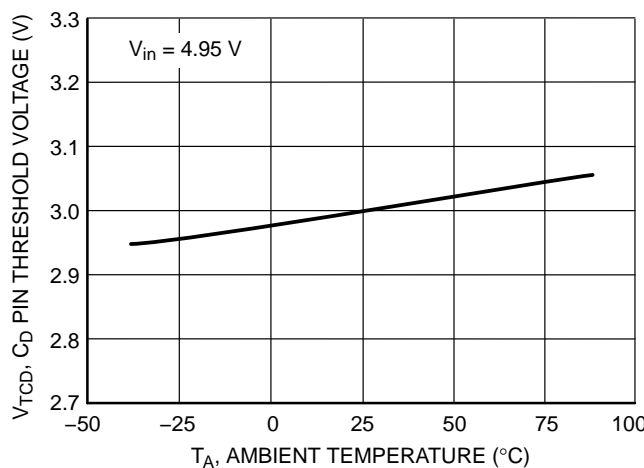
**Figure 5. NCP302/3 Series 4.5 V  
Detector Threshold Voltage vs. Temperature**



**Figure 6. NCP302/3 Series 0.9 V  
C<sub>D</sub> Delay Pin Threshold Voltage vs. Temperature**

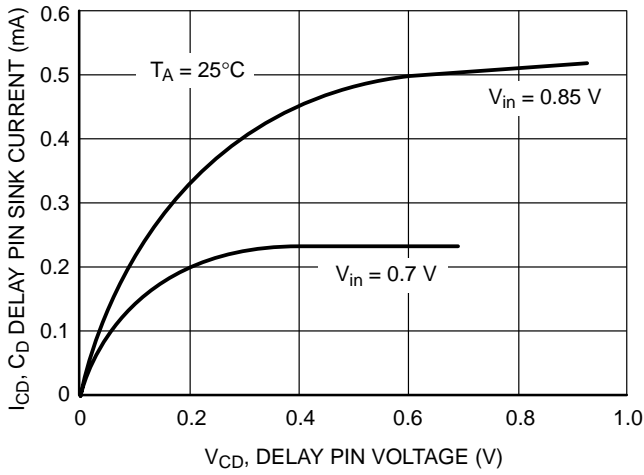


**Figure 7. NCP302/3 Series 2.7 V  
C<sub>D</sub> Delay Pin Threshold Voltage vs. Temperature**

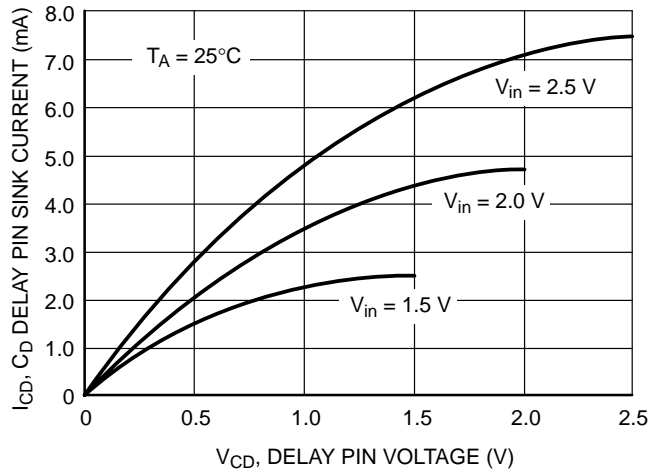


**Figure 8. NCP302/3 Series 4.5 V  
C<sub>D</sub> Delay Pin Threshold Voltage vs. Temperature**

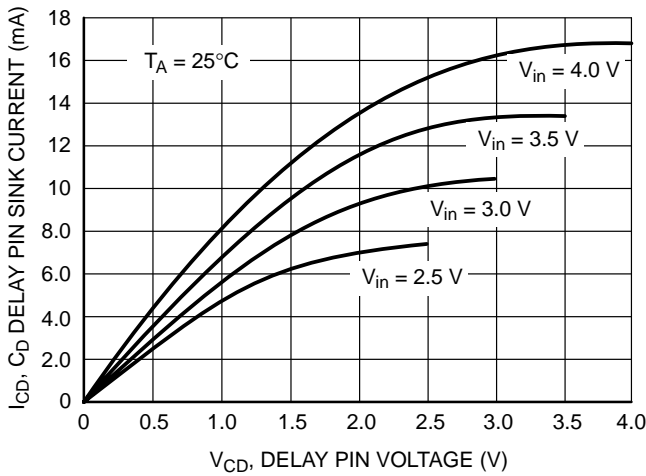
# NCP302, NCP303



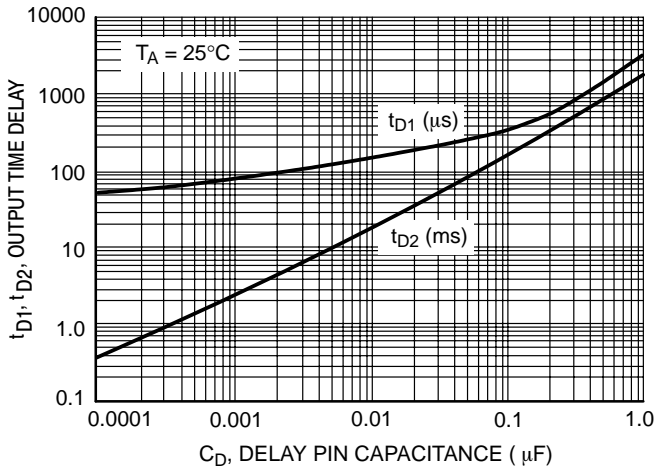
**Figure 9. NCP302/3 Series 0.9 V  
C<sub>D</sub> Delay Pin Sink Current vs. Voltage**



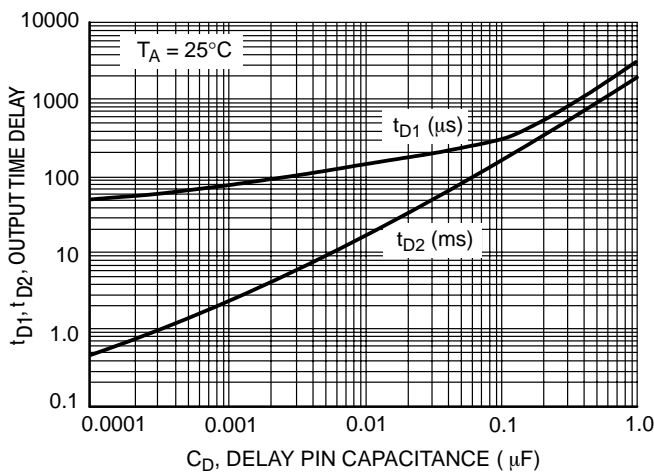
**Figure 10. NCP302/3 Series 2.7 V  
C<sub>D</sub> Delay Pin Sink Current vs. Voltage**



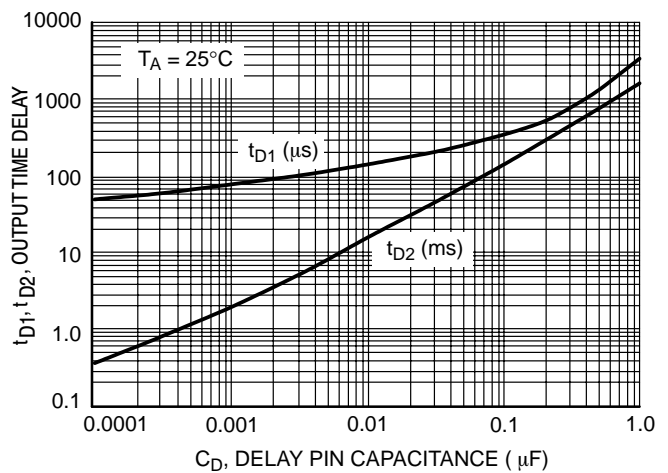
**Figure 11. NCP302/3 Series 4.5 V  
C<sub>D</sub> Delay Pin Sink Current vs. Voltage**



**Figure 12. NCP302/3 Series 0.9 V  
Output Time Delay vs. Capacitance**

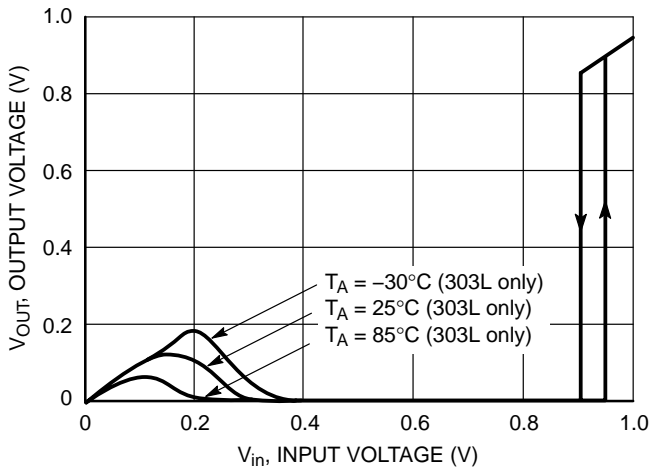


**Figure 13. NCP302/3 Series 2.7 V  
Output Time Delay vs. Capacitance**

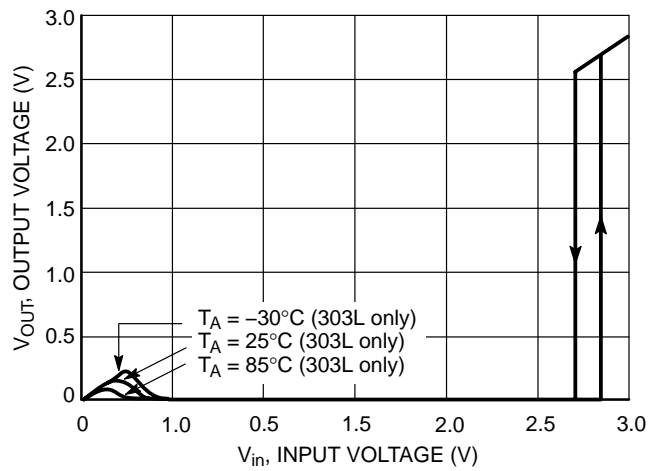


**Figure 14. NCP302/3 Series 4.5 V  
Output Time Delay vs. Capacitance**

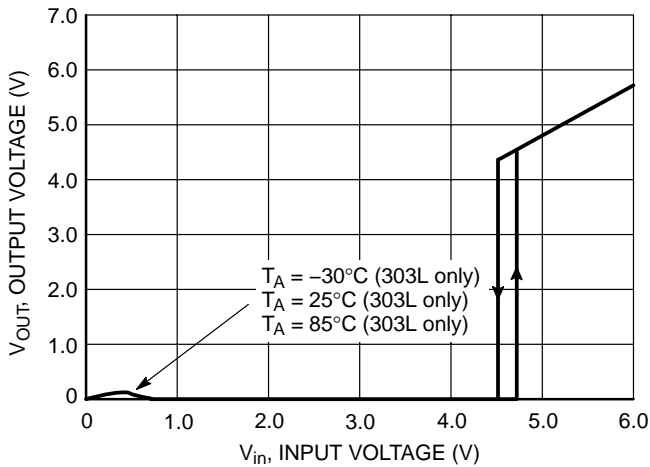
# NCP302, NCP303



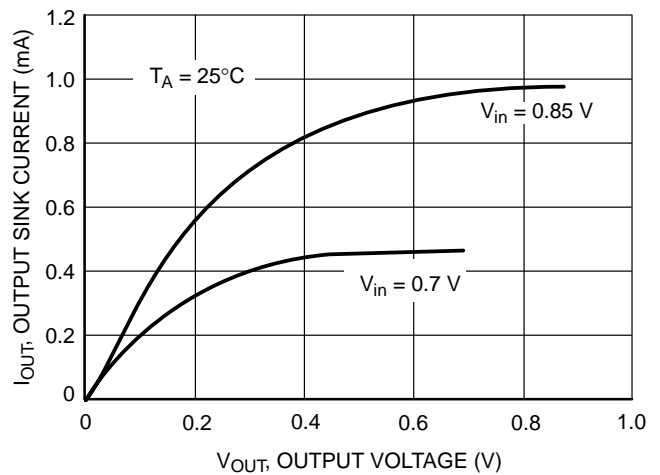
**Figure 15. NCP302L/3L Series 0.9 V Reset Output Voltage vs. Input Voltage**



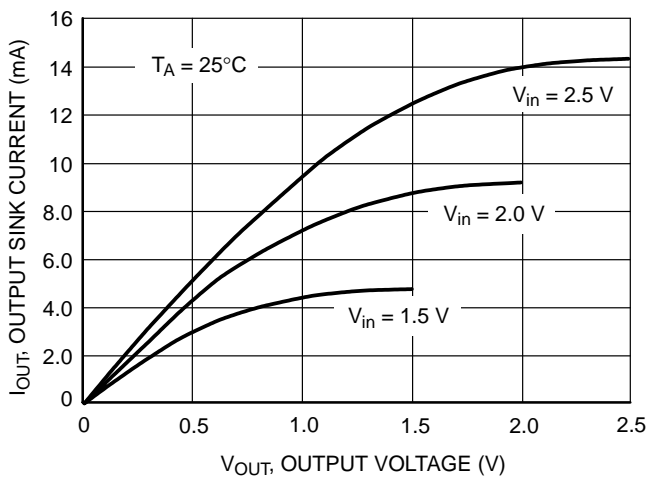
**Figure 16. NCP302L/3L Series 2.7 V Reset Output Voltage vs. Input Voltage**



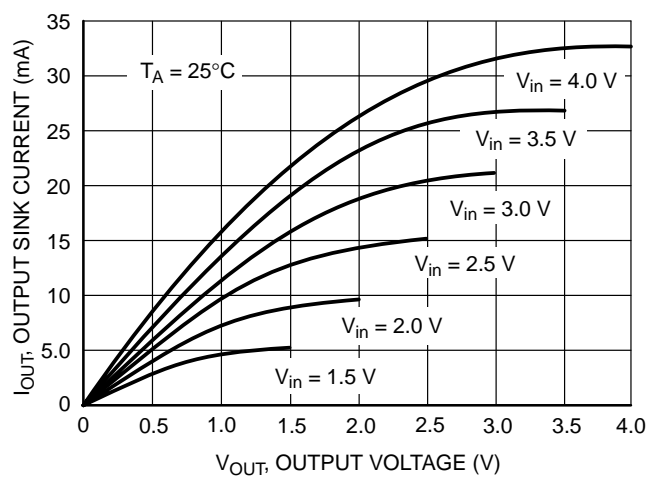
**Figure 17. NCP302L/3L Series 4.5 V Reset Output Voltage vs. Input Voltage**



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

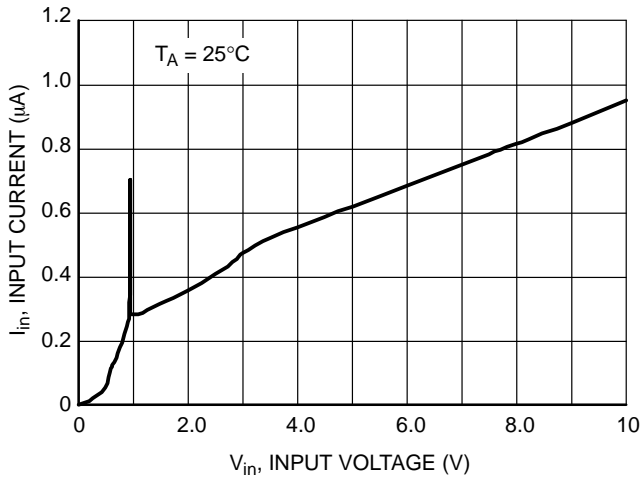


**Figure 19. NCP302H/3L Series 2.7 V Reset Output Sink Current vs. Output Voltage**

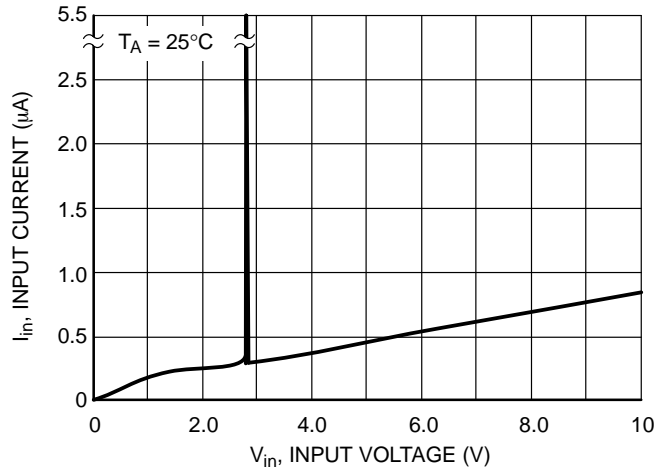


**Figure 20. NCP302H/3L Series 4.5 V Reset Output Sink Current vs. Output Voltage**

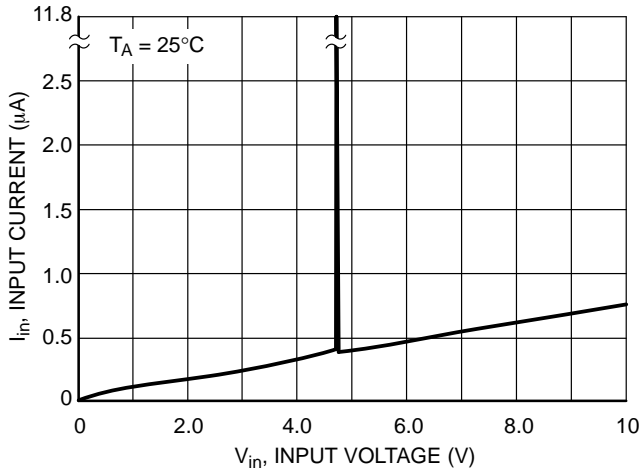
# NCP302, NCP303



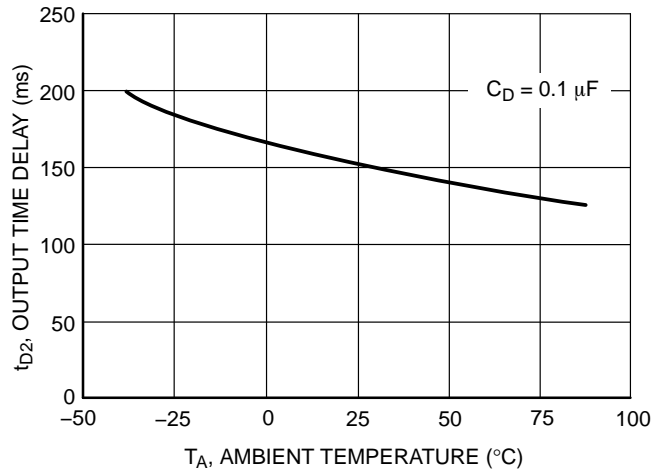
**Figure 21. NCP302/3 Series 0.9 V Input Current vs. Input Voltage**



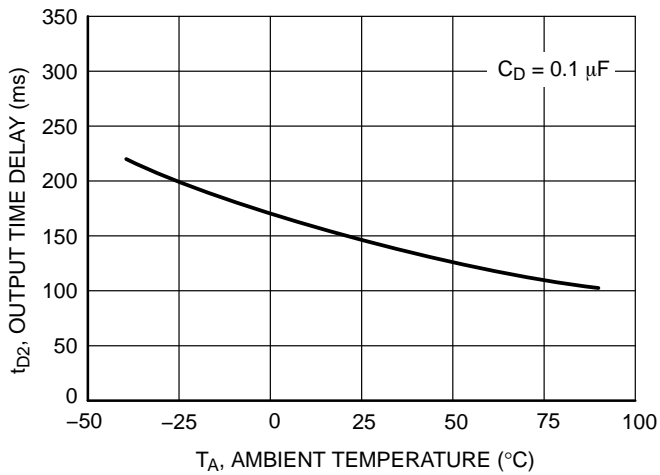
**Figure 22. NCP302/3 Series 2.7 V Input Current vs. Input Voltage**



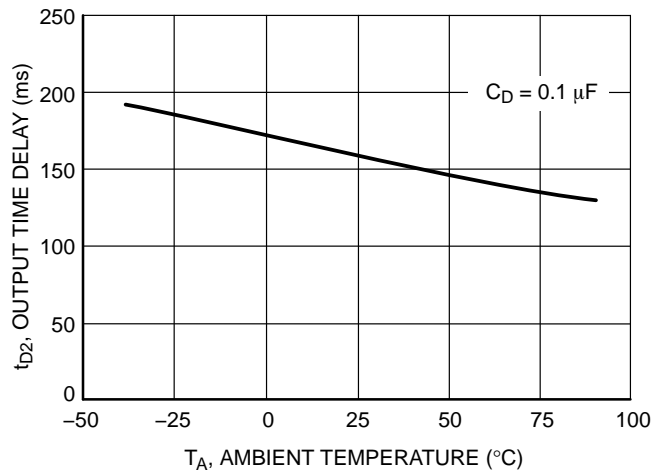
**Figure 23. NCP302/3 Series 4.5 V Input Current vs. Input Voltage**



**Figure 24. NCP302/3 Series 0.9 V Reset Output Time Delay vs. Temperature**

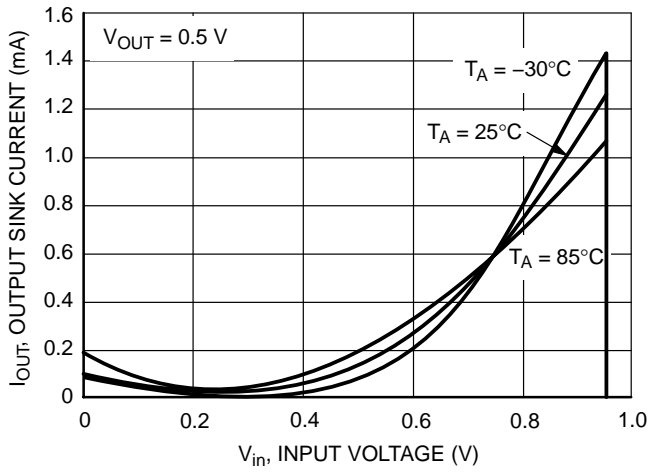


**Figure 25. NCP302/3 Series 2.7 V Reset Output Time Delay vs. Temperature**

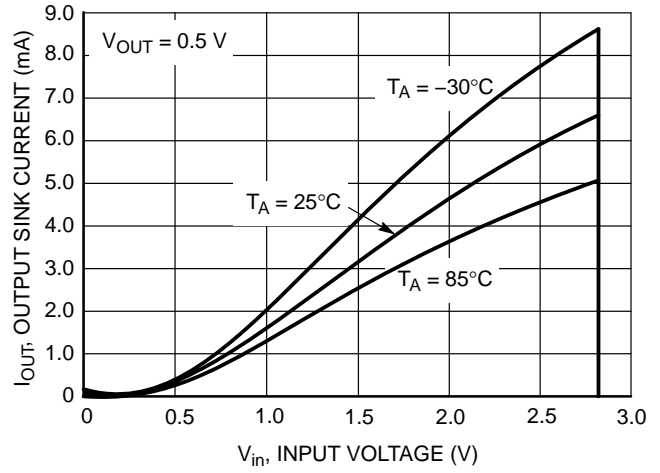


**Figure 26. NCP302/3 Series 4.5 V Reset Output Time Delay vs. Temperature**

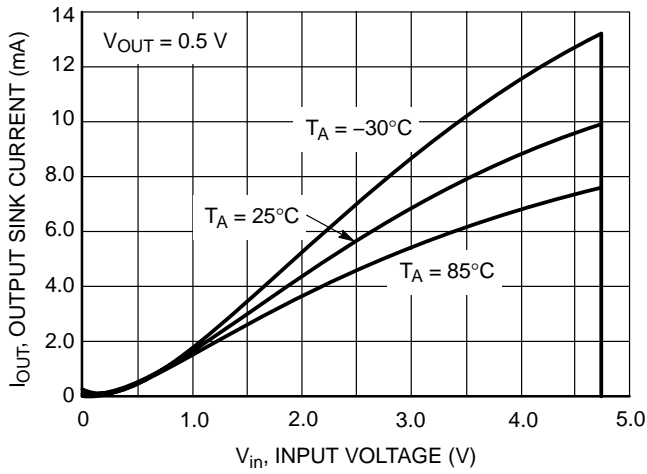
# NCP302, NCP303



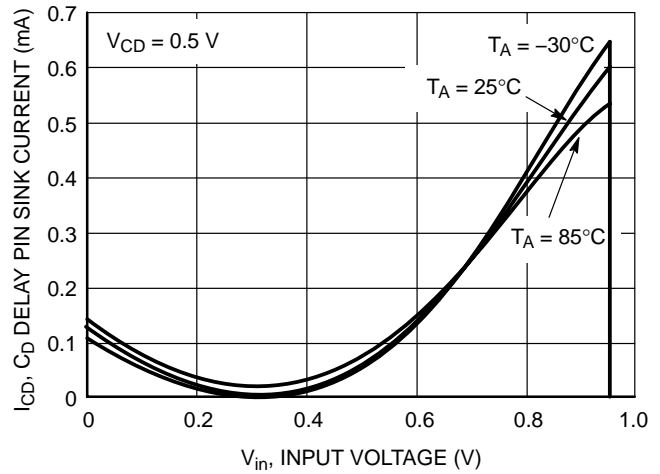
**Figure 27. NCP302H/3L Series 0.9 V Reset Output Sink Current vs. Input Voltage**



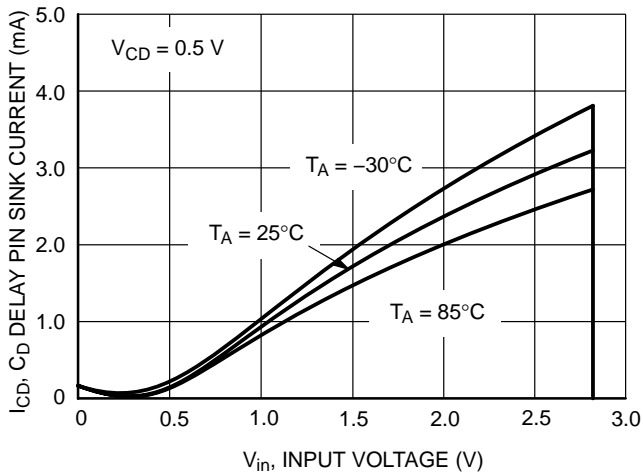
**Figure 28. NCP302H/3L Series 2.7 V Reset Output Sink Current vs. Input Voltage**



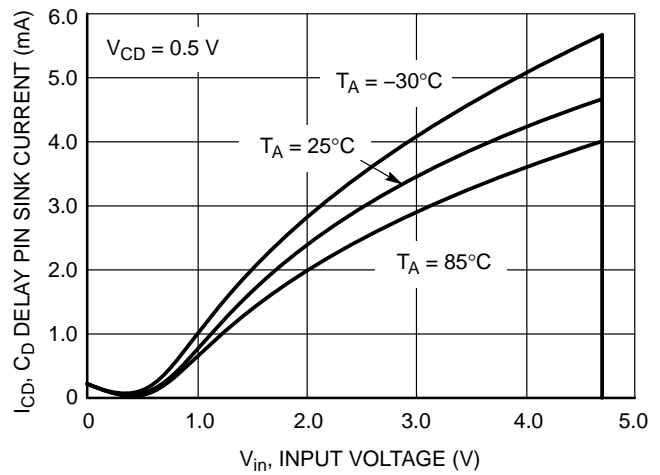
**Figure 29. NCP302H/3L Series 4.5 V Reset Output Sink Current vs. Input Voltage**



**Figure 30. NCP302/3 Series 0.9 V C<sub>D</sub> Delay Pin Sink Current vs. Input Voltage**

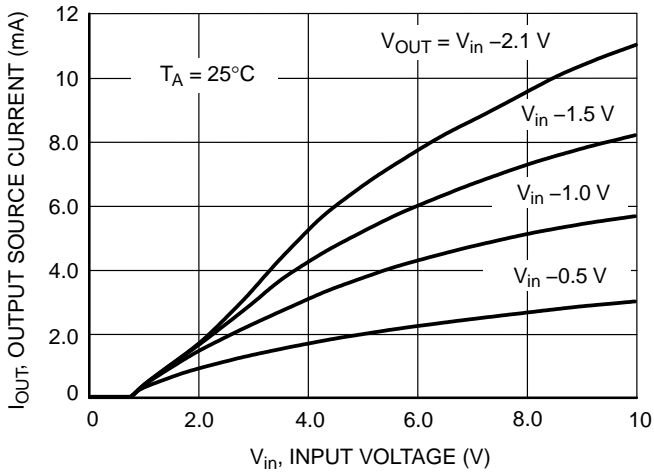


**Figure 31. NCP302/3 Series 2.7 V C<sub>D</sub> Delay Pin Sink Current vs. Input Voltage**

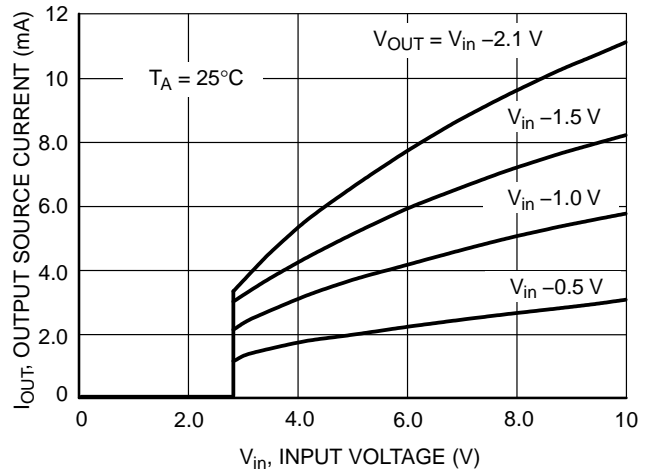


**Figure 32. NCP302/3 Series 4.5 V C<sub>D</sub> Delay Pin Sink Current vs. Input Voltage**

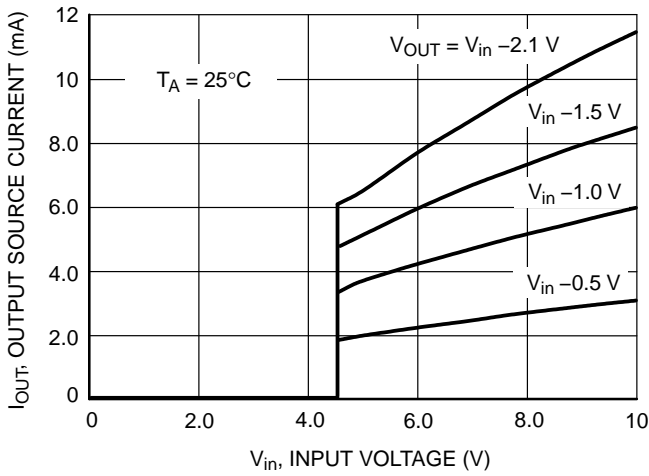
# NCP302, NCP303



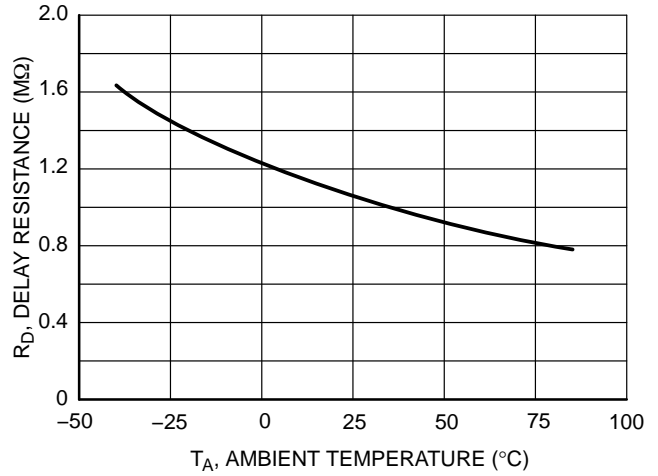
**Figure 33. NCP302L Series 0.9 V**  
Reset Output Source Current vs. Input Voltage



**Figure 34. NCP302L Series 2.7 V**  
Reset Output Source Current vs. Input Voltage



**Figure 35. NCP302L Series 4.5 V**  
Reset Output Source Current vs. Input Voltage



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

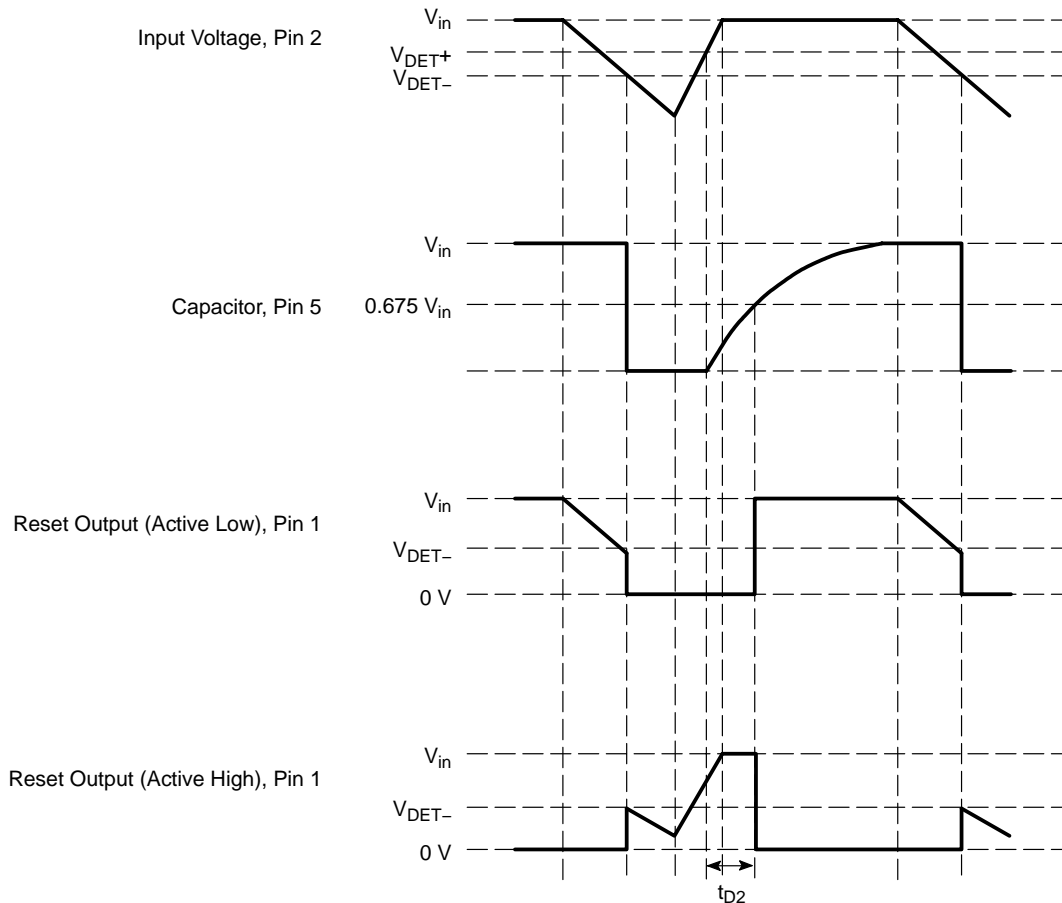


**OPERATING DESCRIPTION**

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 12 through 14. 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 45 show various application examples.



**Figure 37. Timing Waveforms**

# NCP302, NCP303

## APPLICATION CIRCUIT INFORMATION

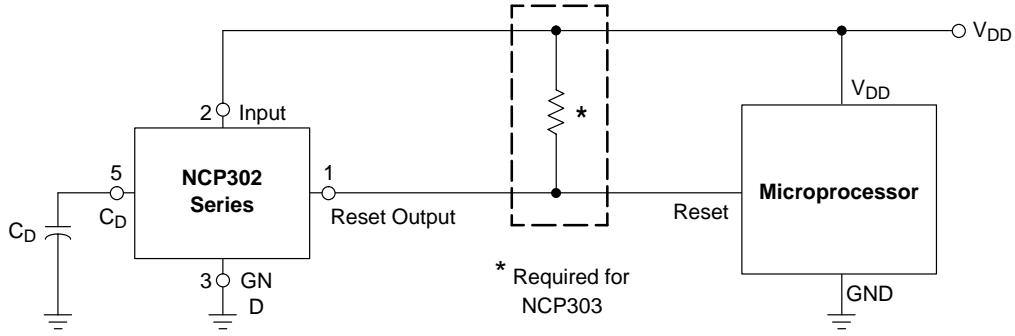


Figure 38. Microprocessor Reset Circuit

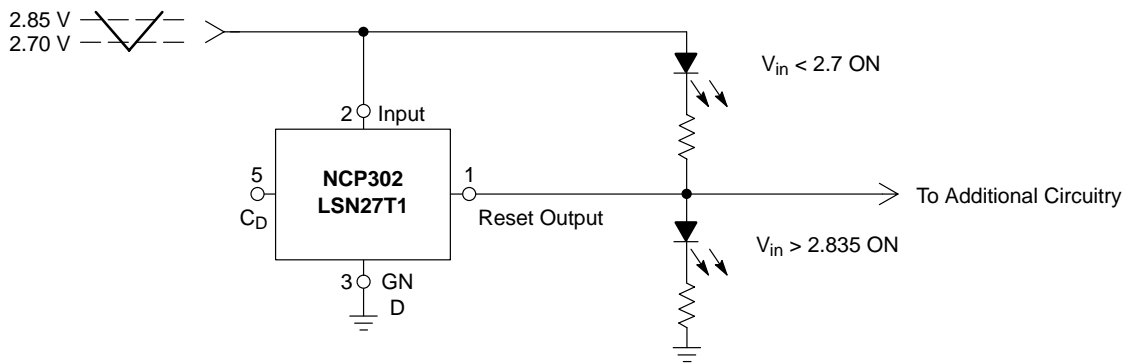


Figure 39. Battery Charge Indicator

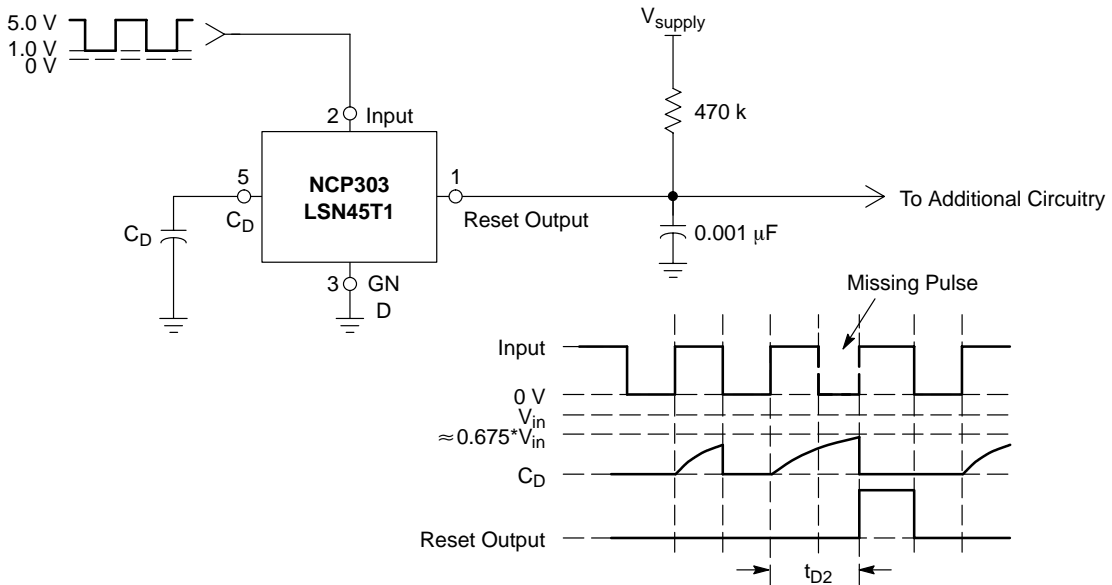
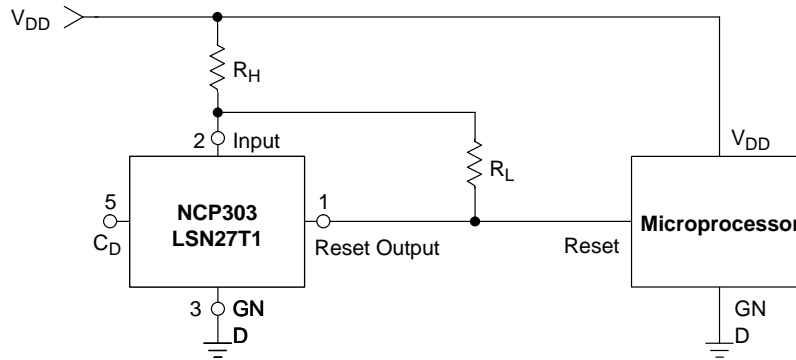


Figure 40. Missing Pulse Detector or Frequency Detector

## 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  $I_{in} = 0.26 \mu\text{A}$  at 2.6 V.

$V_{in}$  Decreasing:

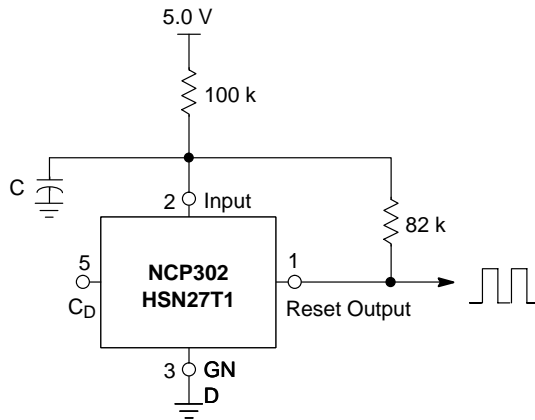
$$V_{th} = \left( \frac{R_H}{R_{in}} + 1 \right) (V_{DET-})$$

$V_{in}$  Increasing:

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

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

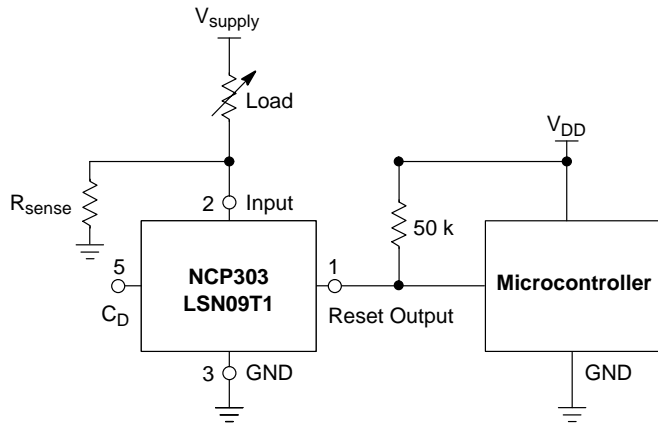
Test Data				
$V_{th}$ Decreasing (V)	$V_{th}$ Increasing (V)	$V_{HYS}$ (V)	$R_H$ ( $\Omega$ )	$R_L$ (k $\Omega$ )
2.70	2.84	0.135	0	–
2.70	2.87	0.17	100	10
2.70	2.88	0.19	100	6.8
2.70	2.91	0.21	100	4.3
2.70	2.90	0.20	220	10
2.70	2.94	0.24	220	6.8
2.70	2.98	0.28	220	4.3
2.70	2.70	0.27	470	10
2.70	3.04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



Test Data		
C ( $\mu\text{F}$ )	$f_{OSC}$ (kHz)	$I_Q$ ( $\mu\text{A}$ )
0.01	2590	21.77
0.1	490	21.97
1.0	52	22.07

**Figure 42. Simple Clock Oscillator**

## NCP302, NCP303

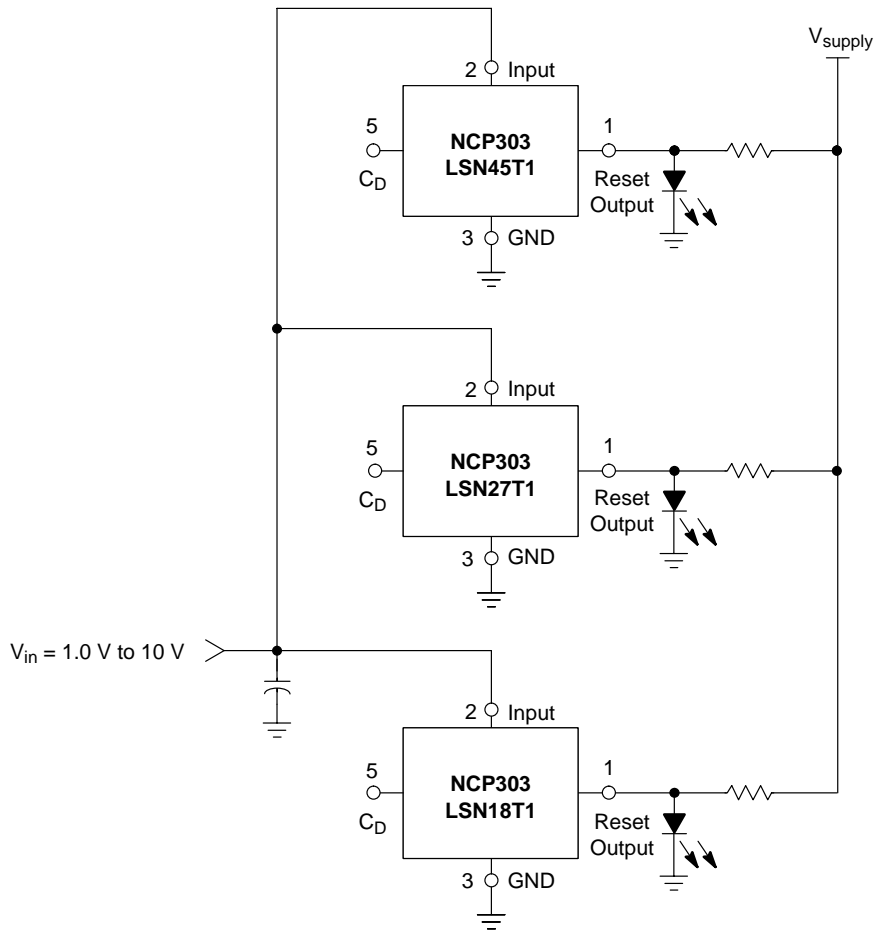


This circuit monitors the current at the load. As current flows through the load, a voltage drop with respect to ground appears across  $R_{sense}$  where  $V_{sense} = I_{load} * R_{sense}$ . The following conditions apply:

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

## ORDERING INFORMATION

Device	Threshold Voltage	Output Type	Reset	Marking	Package	Shipping†
NCP302LSN09T1	0.9	CMOS	Active Low	SBO	TSOP-5	3000 / Tape & Reel (7 inch Reel)
NCP302LSN09T1G	0.9			SBO	TSOP-5 (Pb-Free)	
NCP302LSN15T1	1.5			SBI	TSOP-5	
NCP302LSN18T1	1.8			SBF	TSOP-5	
NCP302LSN20T1	2.0			SBD	TSOP-5	
NCP302LSN27T1	2.7			SAW	TSOP-5	
NCP302LSN27T1G	2.7			SAW	TSOP-5 (Pb-Free)	
NCP302LSN30T1	3.0			SAT	TSOP-5	
NCP302LSN30T1G	3.0			SAT	TSOP-5 (Pb-Free)	
NCP302LSN33T1	3.3			SAQ	TSOP-5	
NCP302LSN33T1G	3.3			SAQ	TSOP-5 (Pb-Free)	
NCP302LSN38T1	3.8			SAK	TSOP-5 (Pb-Free)	
NCP302LSN38T1G	3.8			SAK	TSOP-5	
NCP302LSN40T1	4.0			SAI	TSOP-5	
NCP302LSN43T1	4.3			SAF	TSOP-5	
NCP302LSN45T1	4.5			SAL	TSOP-5	
NCP302LSN45T1G	4.5			SAL	TSOP-5 (Pb-Free)	
NCP302LSN47T1	4.7			SAC	TSOP-5	
NCP302HSN09T1	0.9	CMOS	Active High	SDO	TSOP-5	
NCP302HSN18T1	1.8			SFH	TSOP-5	
NCP302HSN27T1	2.7			SDK	TSOP-5	
NCP302HSN30T1	3.0			SDI	TSOP-5	
NCP302HSN40T1	4.0			SJH	TSOP-5	
NCP302HSN45T1	4.5			SDG	TSOP-5	
NCP302HSN45T1G	4.5			SDG	TSOP-5 (Pb-Free)	
NCP303LSN09T1	0.9	Open Drain	Active Low	SDE	TSOP-5	
NCP303LSN09T1G	0.9			SDE	TSOP-5 (Pb-Free)	
NCP303LSN10T1	1.0			SDD	TSOP-5	
NCP303LSN10T1G	1.0			SDD	TSOP-5 (Pb-Free)	
NCP303LSN11T1	1.1			SDC	TSOP-5	

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 ON Semiconductor 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 Specifications Brochure, BRD8011/D.

## NCP302, NCP303

### ORDERING INFORMATION

Device	Threshold Voltage	Output Type	Reset	Marking	Package	Shipping†
NCP303LSN13T1	1.3	Open Drain	Active Low	SDA	TSOP-5	3000 / Tape & Reel (7 inch Reel)
NCP303LSN14T1	1.4			SCZ	TSOP-5	
NCP303LSN15T1	1.5			SCY	TSOP-5	
NCP303LSN15T1G	1.5			SCY	TSOP-5 (Pb-Free)	
NCP303LSN16T1	1.6			SCX	TSOP-5	
NCP303LSN18T1	1.8			SCV	TSOP-5	
NCP303LSN20T1	2.0			SCT	TSOP-5	
NCP303LSN20T1G	2.0			SCT	TSOP-5 (Pb-Free)	
NCP303LSN22T1	2.2			SCR	TSOP-5	
NCP303LSN23T1	2.3			SCQ	TSOP-5	
NCP303LSN24T1	2.4			SCP	TSOP-5	
NCP303LSN25T1	2.5			SCO	TSOP-5	
NCP303LSN25T1G	2.5			SCO	TSOP-5 (Pb-Free)	
NCP303LSN26T1	2.6			SCN	TSOP-5	
NCP303LSN26T1G	2.6			SCN	TSOP-5 (Pb-Free)	
NCP303LSN27T1	2.7			SCM	TSOP-5	
NCP303LSN27T1G	2.7			SCM	TSOP-5 (Pb-Free)	
NCP303LSN28T1	2.8			SCL	TSOP-5	
NCP303LSN28T1G	2.8			SCL	TSOP-5 (Pb-Free)	
NCP303LSN29T1	2.9			SCK	TSOP-5	
NCP303LSN29T1G	2.9			SCK	TSOP-5 (Pb-Free)	
NCP303LSN30T1	3.0			SCJ	TSOP-5	
NCP303LSN30T1G	3.0			SCJ	TSOP-5 (Pb-Free)	
NCP303LSN31T1	3.1			SCI	TSOP-5	
NCP303LSN32T1	3.2			SCH	TSOP-5	
NCP303LSN33T1	3.3			SCG	TSOP-5	
NCP303LSN34T1	3.4			SCF	TSOP-5	
NCP303LSN36T1	3.6			SCD	TSOP-5	
NCP303LSN38T1	3.8			SCA	TSOP-5	

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 ON Semiconductor 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 Specifications Brochure, BRD8011/D.

## NCP302, NCP303

### ORDERING INFORMATION

Device	Threshold Voltage	Output Type	Reset	Marking	Package	Shipping†
NCP303LSN40T1	4.0	Open Drain	Active Low	SBY	TSOP-5	3000 / Tape & Reel (7 inch Reel)
NCP303LSN42T1	4.2			SBW	TSOP-5	
NCP303LSN42T1G	4.2			SBW	TSOP-5 (Pb-Free)	
NCP303LSN44T1	4.4			SBU	TSOP-5	
NCP303LSN44T1G	4.4			SBU	TSOP-5 (Pb-Free)	
NCP303LSN45T1	4.5			SBT	TSOP-5	
NCP303LSN45T1G	4.5			SBT	TSOP-5 (Pb-Free)	
NCP303LSN46T1	4.6			SBS	TSOP-5	
NCP303LSN46T1G	4.6			SBS	TSOP-5 (Pb-Free)	
NCP303LSN47T1	4.7			SBR	TSOP-5	

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 ON Semiconductor representative for availability. The electrical characteristics of these additional devices are shown in Tables 1 and 2.

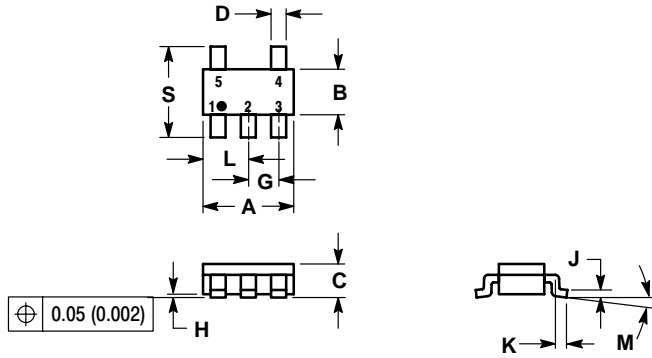
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



# NCP302, NCP303

## PACKAGE DIMENSIONS

### THIN SOT-23-5/TSOP-5/SC59-5 CASE 483-02 ISSUE C

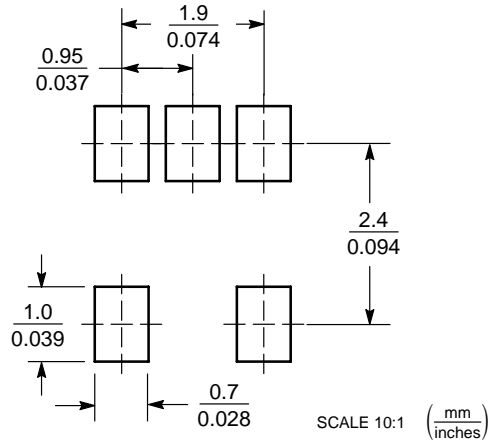


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. A AND B DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.1142	0.1220
B	1.30	1.70	0.0512	0.0669
C	0.90	1.10	0.0354	0.0433
D	0.25	0.50	0.0098	0.0197
G	0.85	1.05	0.0335	0.0413
H	0.013	0.100	0.0005	0.0040
J	0.10	0.26	0.0040	0.0102
K	0.20	0.60	0.0079	0.0236
L	1.25	1.55	0.0493	0.0610
M	0	10	0	10
S	2.50	3.00	0.0985	0.1181

### 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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