

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.

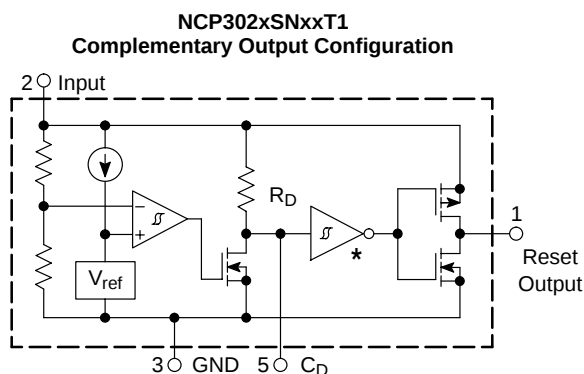
The NCP302 series consists of complementary output devices that are available with either an active high or active low reset. The NCP303 series has an open drain N-Channel output with an active low reset output.

Features

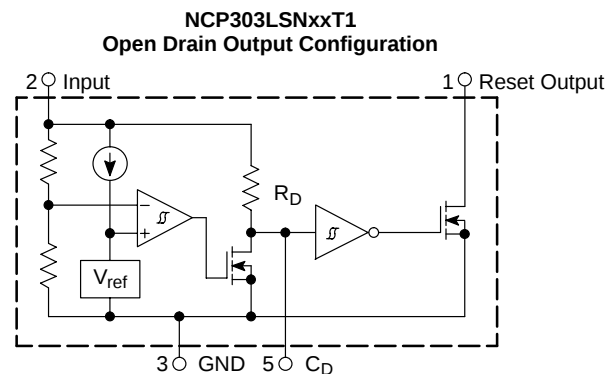
- Quiescent Current of 0.5 μ A Typical
- High Accuracy Undervoltage Threshold of 2.0%
- Externally Programmable Time Delay Generator
- Wide Operating Voltage Range of 0.8 V to 10 V
- Complementary or Open Drain Output
- Active Low or Active High Reset
- Specified Over the -40°C to $+125^{\circ}\text{C}$ Temperature Range (Except for Voltage Options from 0.9 to 1.1 V)
- Pb-Free Packages are Available

Typical Applications

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



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



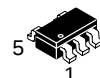
This device contains 28 active transistors.

Figure 1. Representative Block Diagrams



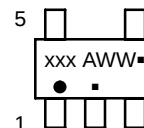
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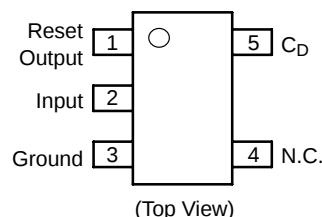
**THIN SOT23-5/
TSOP-5/SC59-5
CASE 483**

MARKING DIAGRAM



xxx = Specific Device Code
A = Assembly Location
WW = 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 23 of this data sheet.

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MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Power Supply Voltage (Pin 2)	V_{in}	12	V
Delay Capacitor Pin Voltage (Pin 5)	V_{CD}	$-0.3 \text{ to } V_{in} + 0.3$	V
Output Voltage (Pin 1) Complementary, NCP302 N-Channel Open Drain, NCP303	V_{OUT}	$-0.3 \text{ to } V_{in} + 0.3$ $-0.3 \text{ to } 12$	V
Output Current (Pin 1) (Note 2)	I_{OUT}	70	mA
Thermal Resistance Junction-to-Air	$R_{\theta JA}$	250	°C/W
Maximum Junction Temperature All NCP Options All NCV Options	T_J	+125 +150	°C
Operating Ambient Temperature Range All Voltage Options: 0.9 V to 1.1 V All Voltage Options: 1.2 V to 4.9 V	T_A T_A	-40 to +85 -40 to +125	°C °C
Storage Temperature Range	T_{stg}	-55 to +150	°C
Moisture Sensitivity Level	MSL	1	
Latchup Performance (Note 3) Positive Negative	$I_{LATCHUP}$	200 200	mA

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.

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.

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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)	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	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

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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					
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	– –	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)	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	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)	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}	– –	0.25 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

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					
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	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)	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}	– –	0.25 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)	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	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

NCP302, NCP303

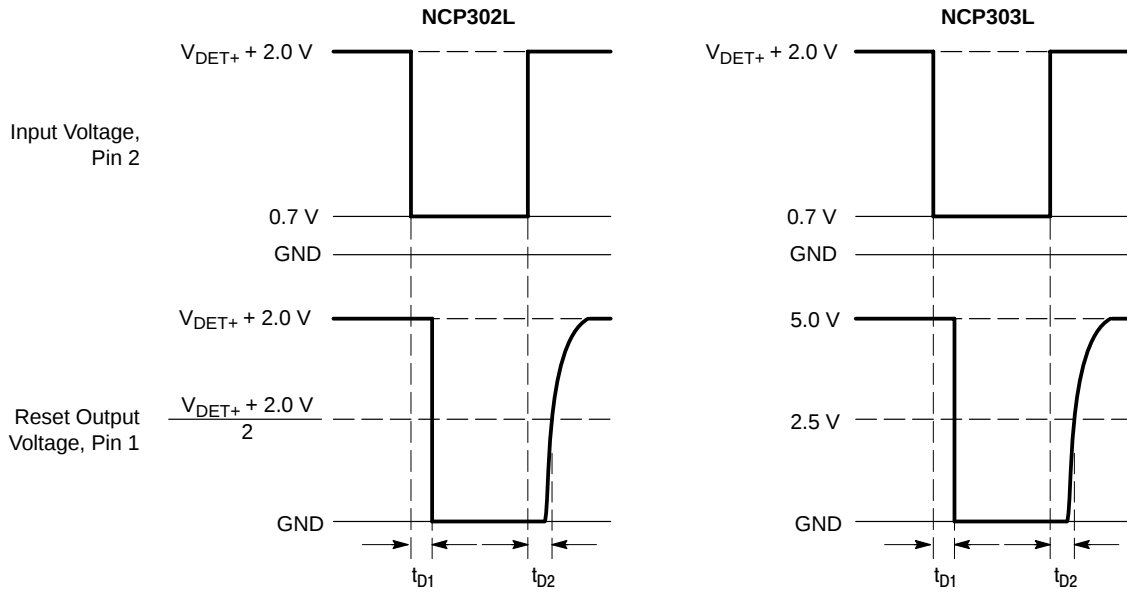
ELECTRICAL CHARACTERISTICS (continued) (For all values $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
NCP302/3 – 4.5					
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 1.5	0.05 2.0 10.5	– – –	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	– –	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)	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	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 ($V_{OUT} = 5.9\text{V}$, $V_{in} = 8.0\text{V}$)	I_{OUT}	0.01 1.0 1.5	0.05 2.0 10.5	– – –	mA
Reset Output Current (Pin 1, Active High 'H' Suffix Devices) 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	– –	μA
Delay Pullup Resistance (Pin 5)	R_D	0.5	1.0	2.0	$\text{M}\Omega$

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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}

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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			
Part Number	V _{DET-} (V)			V _{HYS} (V)			I _{in} (μA) ⁽¹⁾	I _{in} (μA) ⁽²⁾	I _{OUT} (mA) ⁽³⁾	I _{OUT} (mA) ⁽⁴⁾	I _{OUT} (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	0.20	0.45	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							
NCP302LSN12T1	1.176	1.2	1.224	0.036	0.060	0.084						2.0	
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				0.23		0.48	
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	0.25	0.50					
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	0.33	0.52					
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	0.34	0.53					
NCP302LSN49T1	4.802	4.9	4.998	0.147	0.245	0.343							

4. 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

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

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

7. 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

8. 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

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 _{in} Low	V _{in} High		V _{in} Low	V _{in} High
Part Number	V _{DET-} (V)			V _{HYS} (V)			I _{in} (μA) ⁽¹⁾	I _{in} (μA) ⁽²⁾	I _{OUT} (mA) ⁽³⁾	I _{OUT} (mA) ⁽⁴⁾	I _{OUT} (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	0.20	0.45	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					0.18
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			11		0.6
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	0.23	0.48			
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				0.25	0.50
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	0.33	0.52			
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			0.34	0.53	
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					

9. 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

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

11. 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

12. Condition 4: 0.9 — 4.9 V, V_{in} = 0.7 V, V_{OUT} = 0.4 V, Active High 'H' Suffix Devices

13. 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)			V _{HYS} (V)			I _{in} (μA) ⁽¹⁾	I _{in} (μA) ⁽²⁾	I _{OUT} (mA) ⁽³⁾	I _{OUT} (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	0.20	0.45	0.05	0.5		
NCP303LSN10T1	0.980	1.0	1.020	0.030	0.050	0.070						
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				0.23	0.48	2.0
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						
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	0.25	0.50	0.05			
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						
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	0.33	0.52	0.05			
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	0.34	0.53		2.0		
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						

14. 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

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

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

17. 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

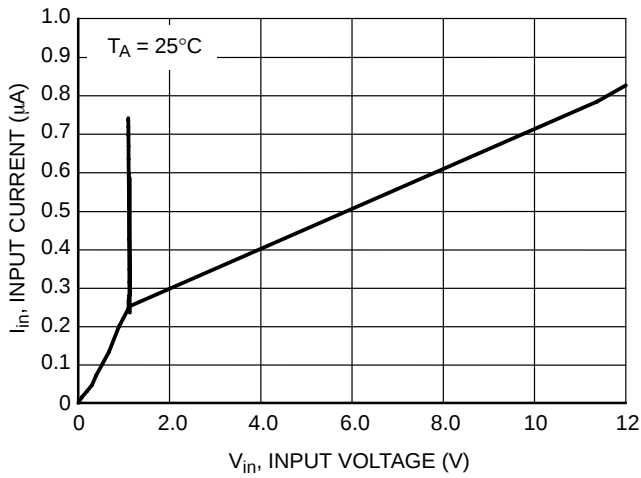


Figure 3. NCP302/3 Series 0.9 V Input Current vs. Input Voltage

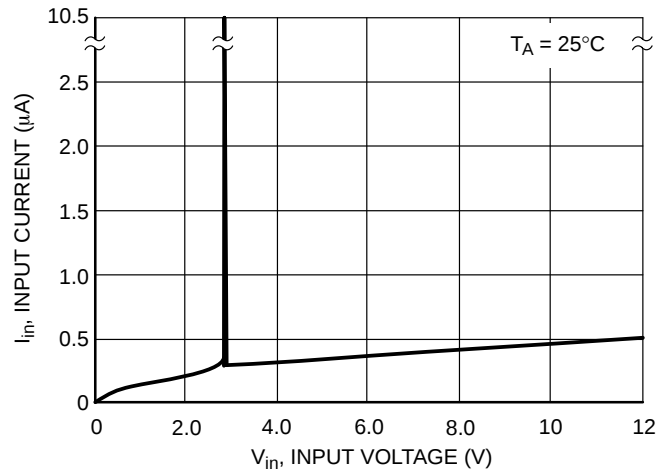


Figure 4. NCP302/3 Series 2.7 V Input Current vs. Input Voltage

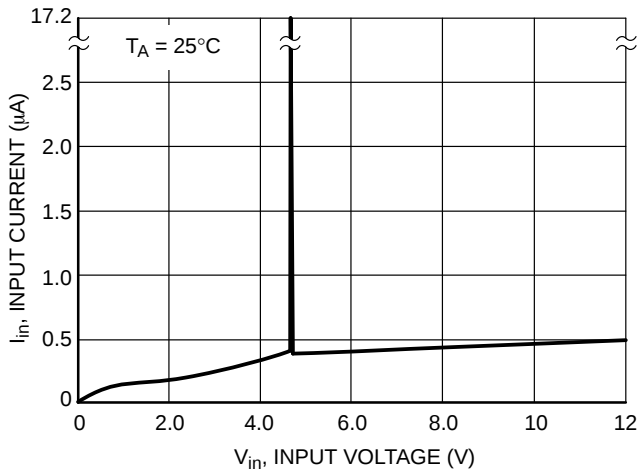


Figure 5. NCP302/3 Series 4.5 V Input Current vs. Input Voltage

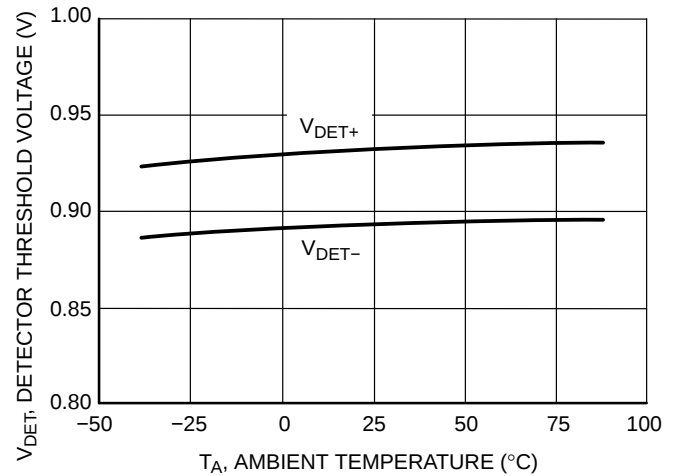


Figure 6. NCP302/3 Series 0.9 V Detector Threshold Voltage vs. Temperature

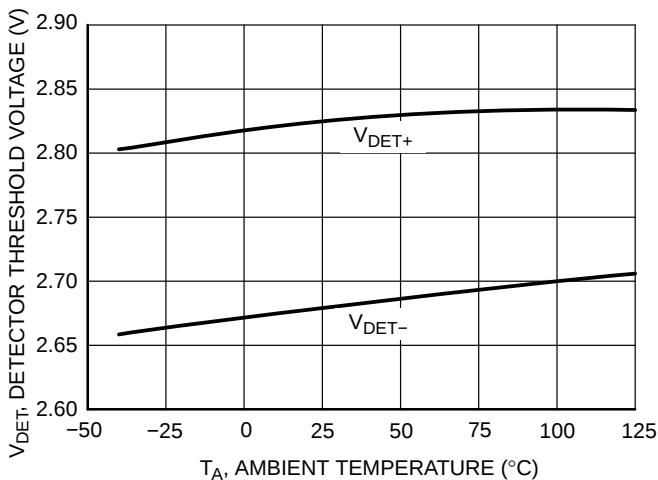


Figure 7. NCP302/3 Series 2.7 V Detector Threshold Voltage vs. Temperature

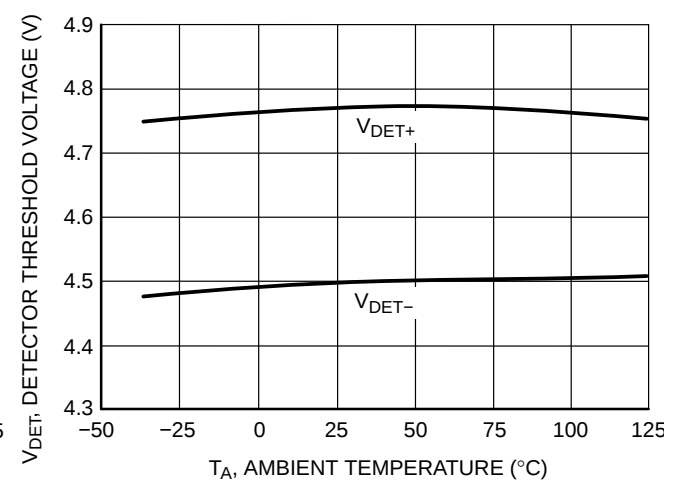


Figure 8. NCP302/3 Series 4.5 V Detector Threshold Voltage vs. Temperature

NCP302, NCP303

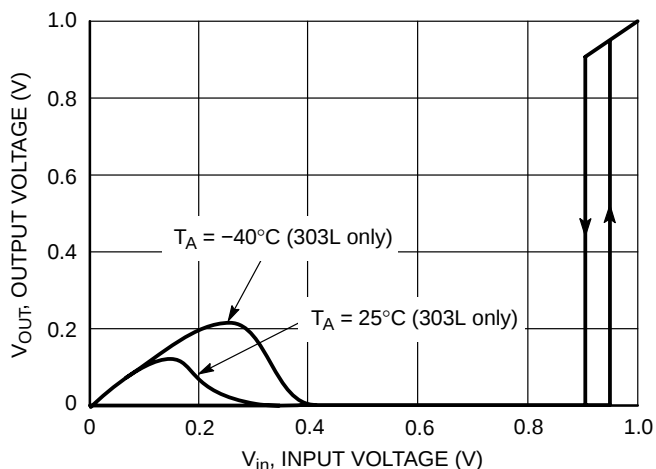


Figure 9. NCP302L/3L Series 0.9 V Reset Output Voltage vs. Input Voltage

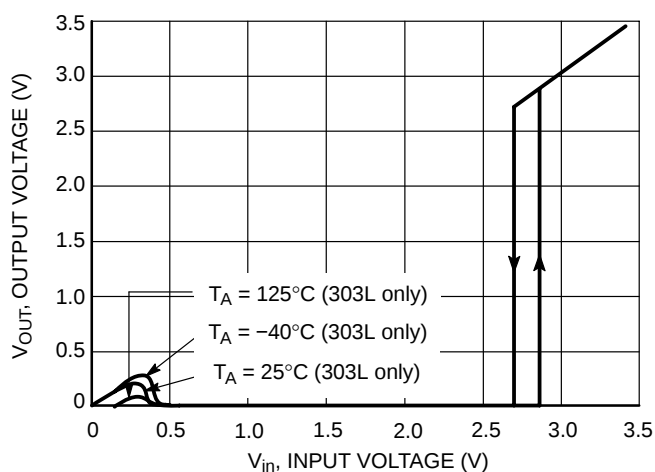


Figure 10. NCP302L/3L Series 2.7 V Reset Output Voltage vs. Input Voltage

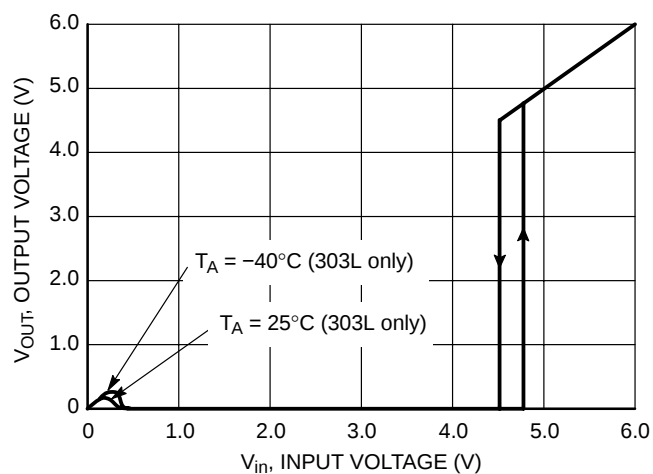


Figure 11. NCP302L/3L Series 4.5 V Reset Output Voltage vs. Input Voltage

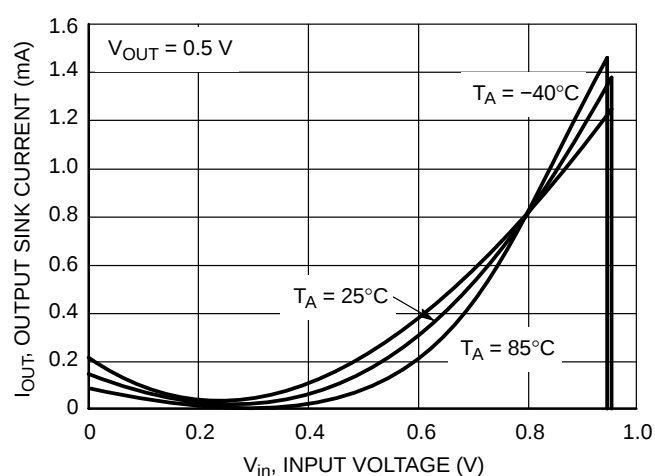


Figure 12. NCP302H/3L Series 0.9 V Reset Output Sink Current vs. Input Voltage

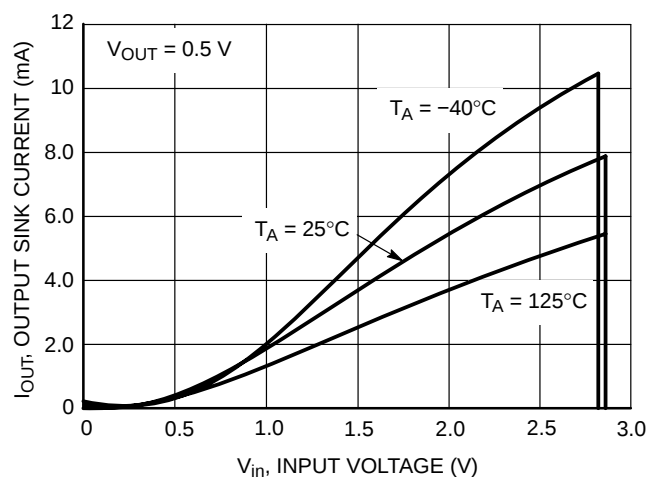


Figure 13. NCP302H/3L Series 2.7 V Reset Output Sink Current vs. Input Voltage

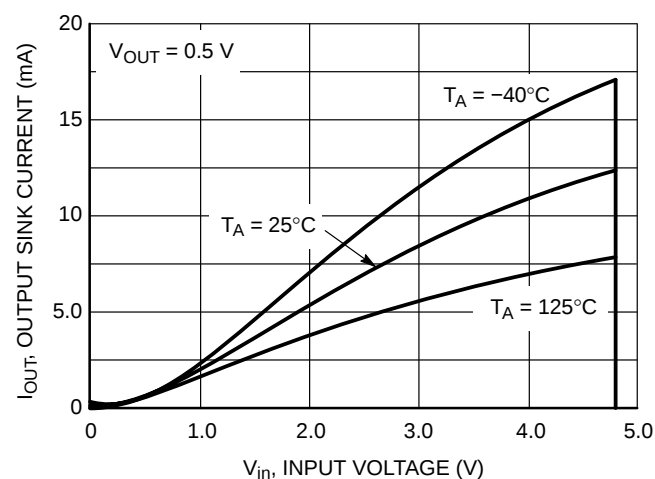


Figure 14. NCP302H/3L Series 4.5 V Reset Output Sink Current vs. Input Voltage

NCP302, NCP303

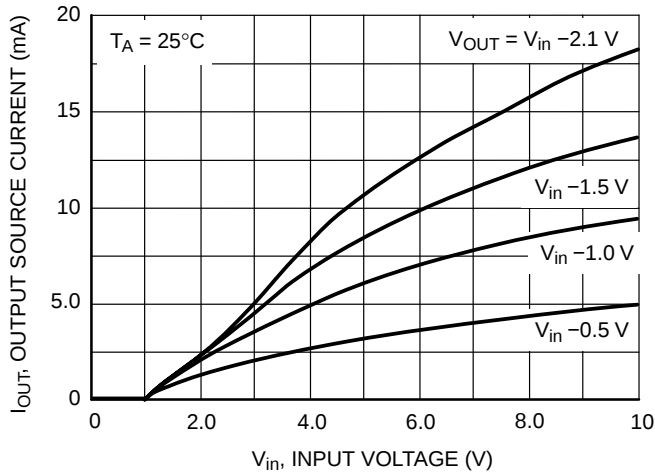


Figure 15. NCP302L Series 0.9 V
Reset Output Source Current vs. Input Voltage

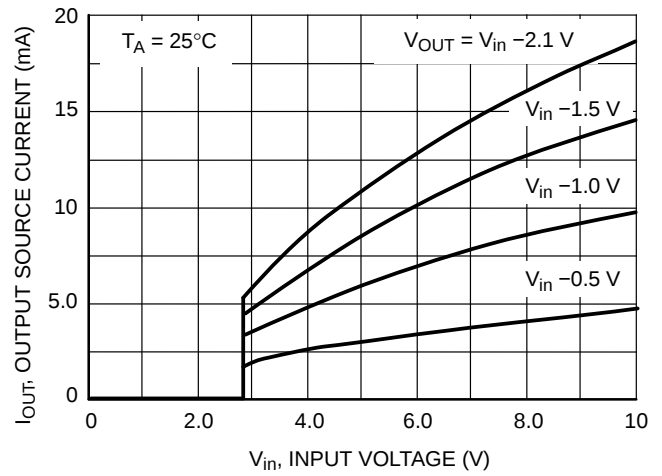


Figure 16. NCP302L Series 2.7 V
Reset Output Source Current vs. Input Voltage

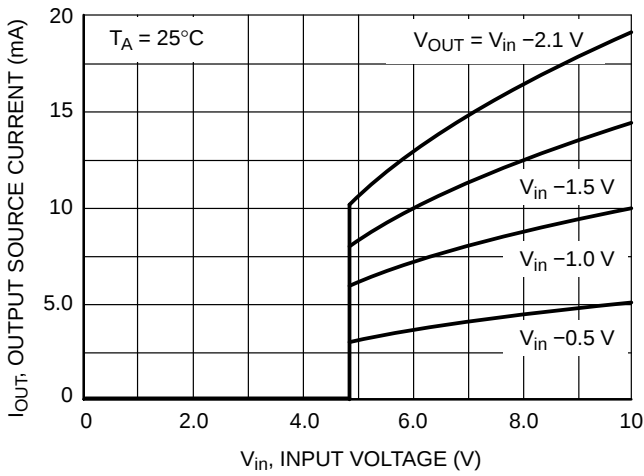


Figure 17. NCP302L Series 4.5 V
Reset Output Source Current vs. Input Voltage

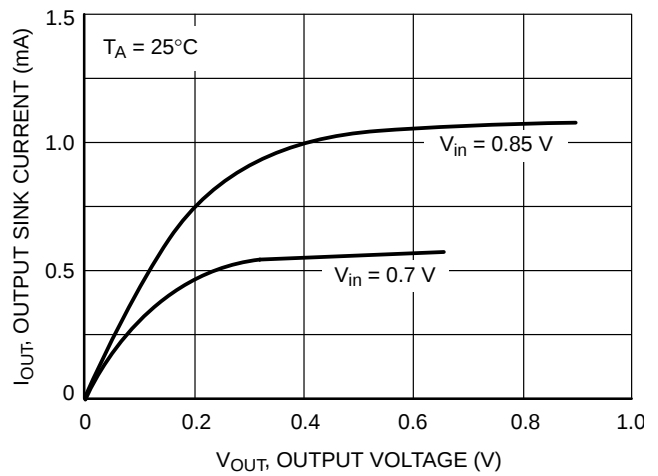


Figure 18. NCP302H/3L Series 0.9 V
Reset Output Sink Current vs. Output Voltage

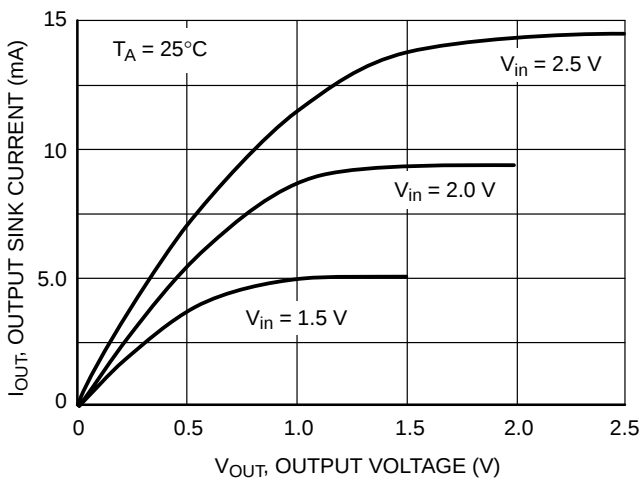


Figure 19. NCP302H/3L Series 2.7 V
Reset Output Sink Current vs. Output Voltage

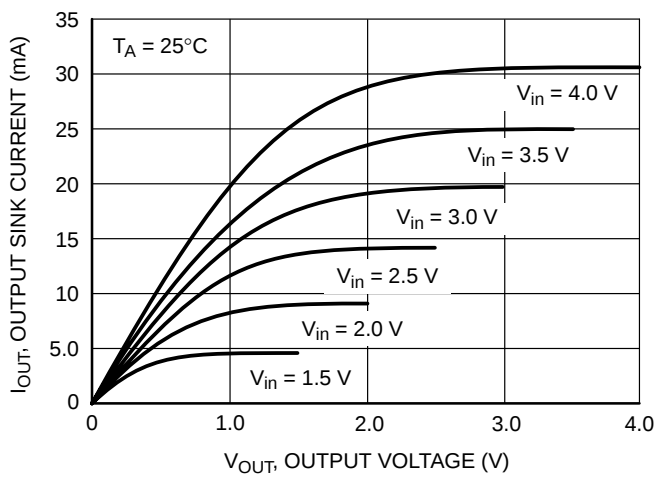


Figure 20. NCP302H/3L Series 4.5 V
Reset Output Sink Current vs. Output Voltage

NCP302, NCP303

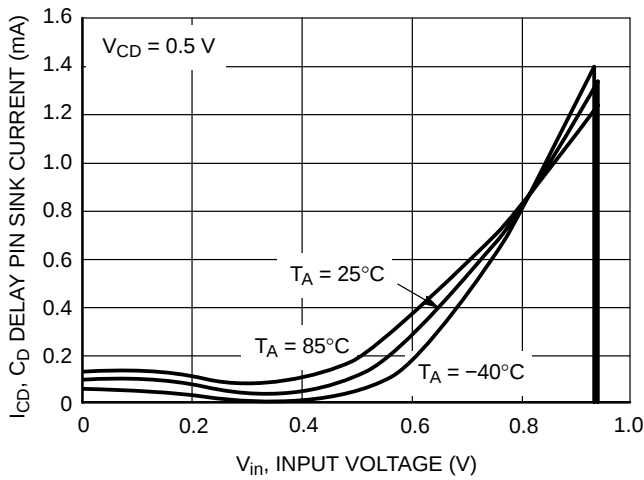


Figure 21. NCP302/3 Series 0.9 V
C_D Delay Pin Sink Current vs. Input Voltage

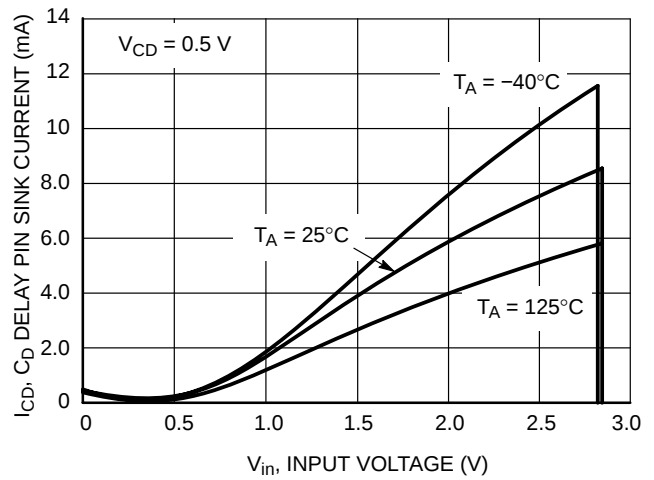


Figure 22. NCP302/3 Series 2.7 V
C_D Delay Pin Sink Current vs. Input Voltage

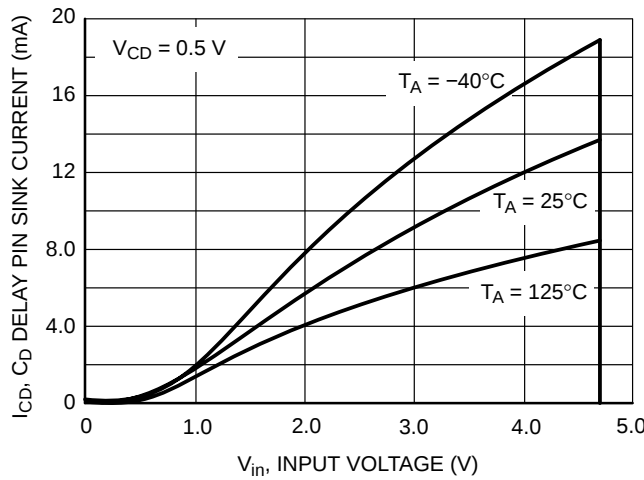


Figure 23. NCP302/3 Series 4.5 V
C_D Delay Pin Sink Current vs. Input Voltage

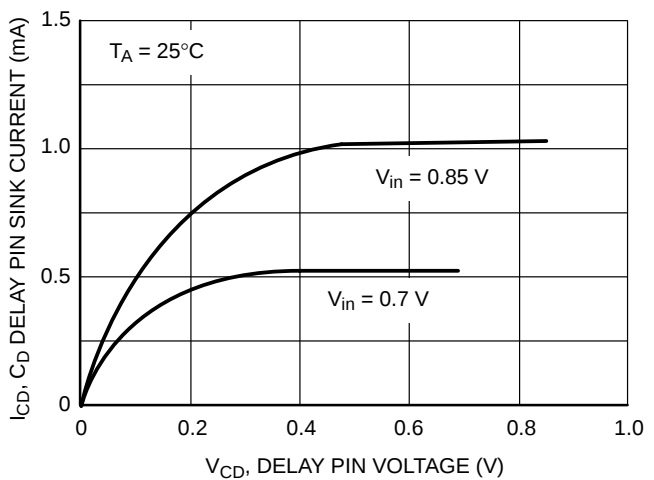


Figure 24. NCP302/3 Series 0.9 V
C_D Delay Pin Sink Current vs. Voltage

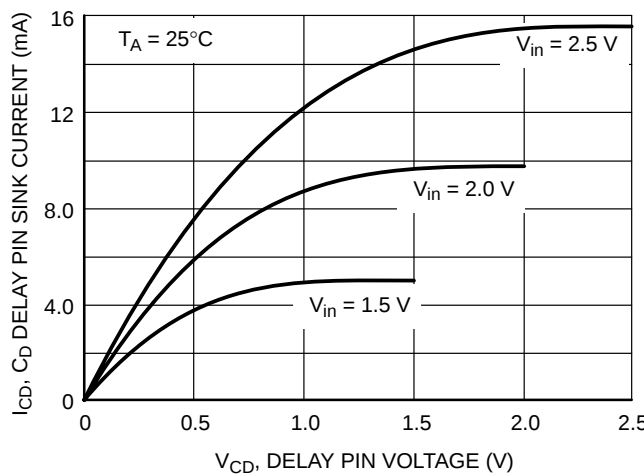


Figure 25. NCP302/3 Series 2.7 V
C_D Delay Pin Sink Current vs. Voltage

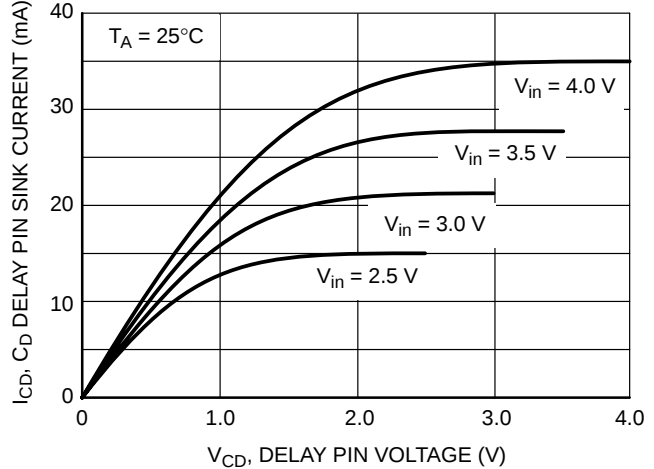


Figure 26. NCP302/3 Series 4.5 V
C_D Delay Pin Sink Current vs. Voltage

NCP302, NCP303

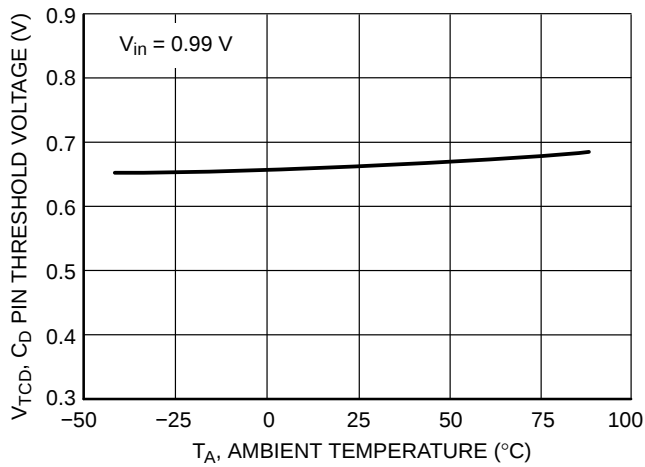


Figure 27. NCP302/3 Series 0.9 V
 C_D Delay Pin Threshold Voltage vs. Temperature

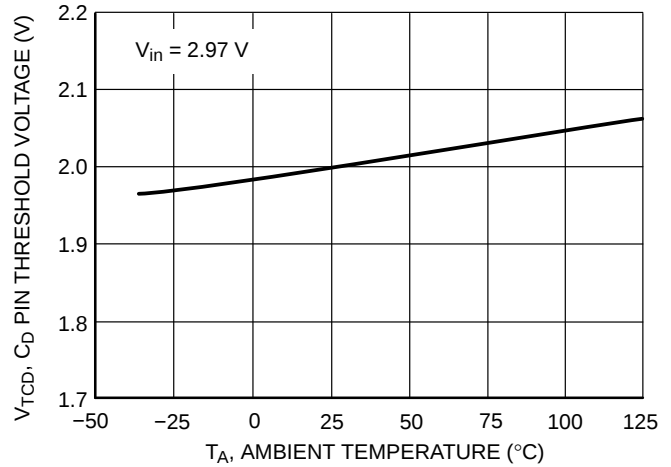


Figure 28. NCP302/3 Series 2.7 V
 C_D Delay Pin Threshold Voltage vs. Temperature

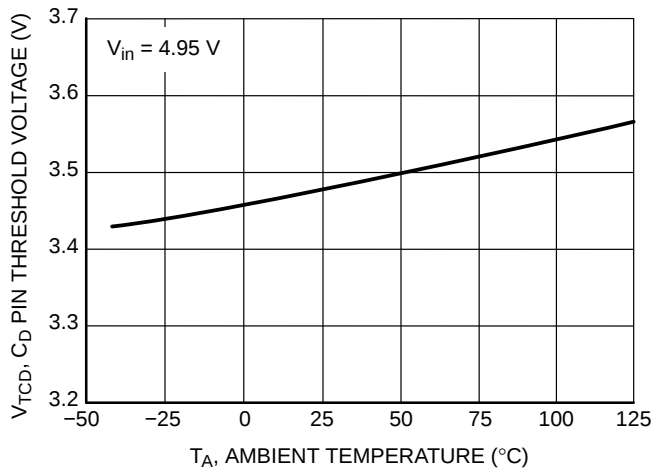


Figure 29. NCP302/3 Series 4.5 V
 C_D Delay Pin Threshold Voltage vs. Temperature

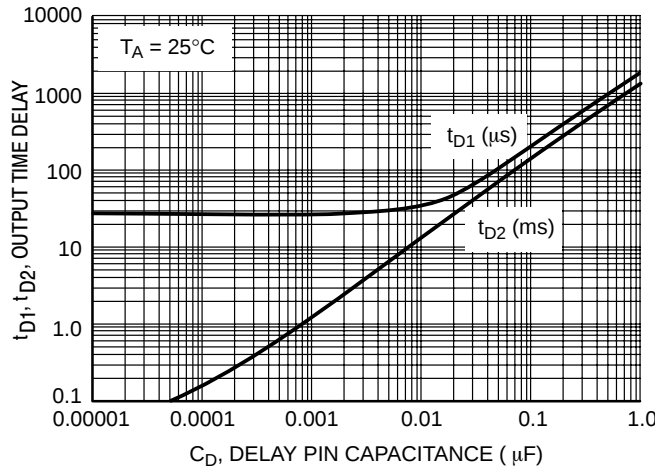


Figure 30. NCP302/3 Series 0.9 V
Output Time Delay vs. Capacitance

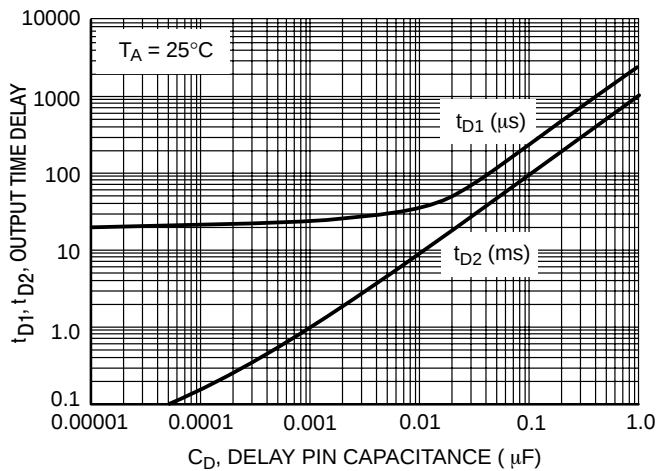


Figure 31. NCP302/3 Series 2.7 V
Output Time Delay vs. Capacitance

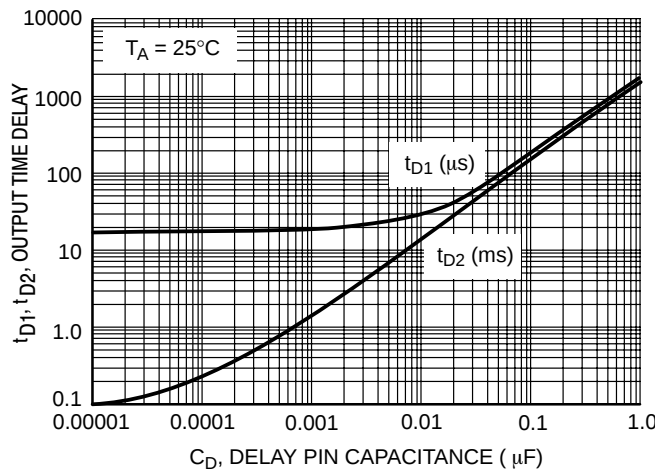
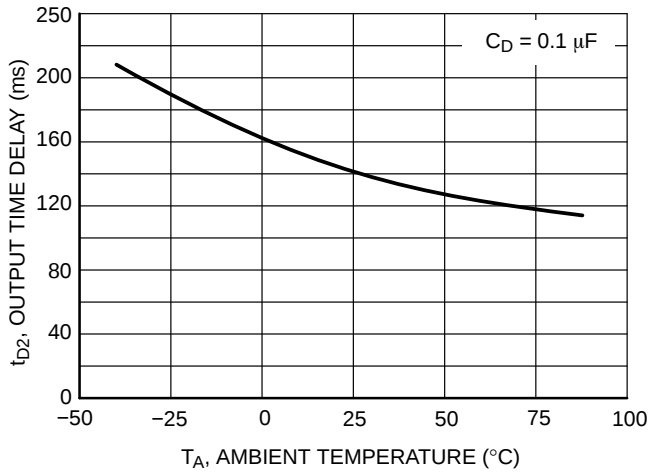
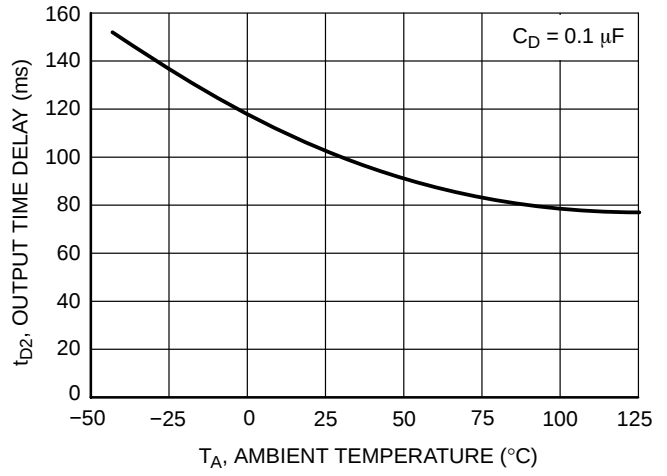


Figure 32. NCP302/3 Series 4.5 V
Output Time Delay vs. Capacitance

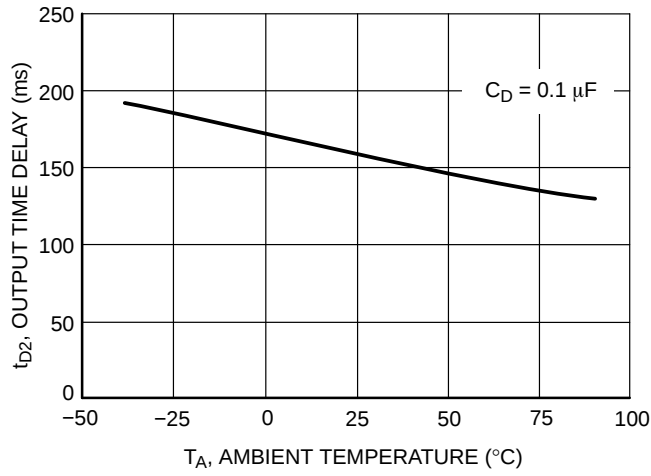
NCP302, NCP303



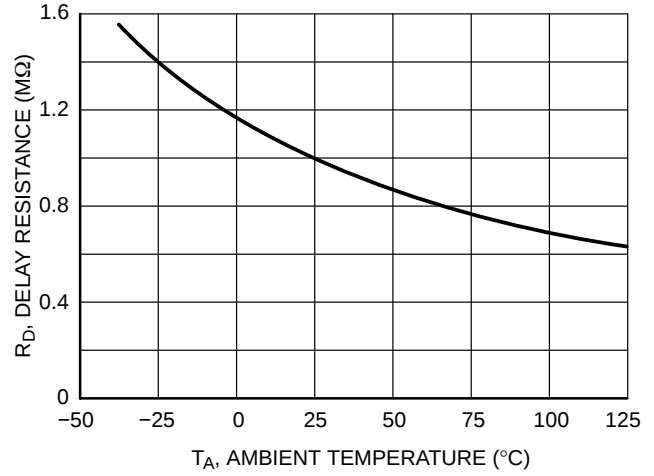
**Figure 33. NCP302/3 Series 0.9 V
Reset Output Time Delay vs. Temperature**



**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 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.

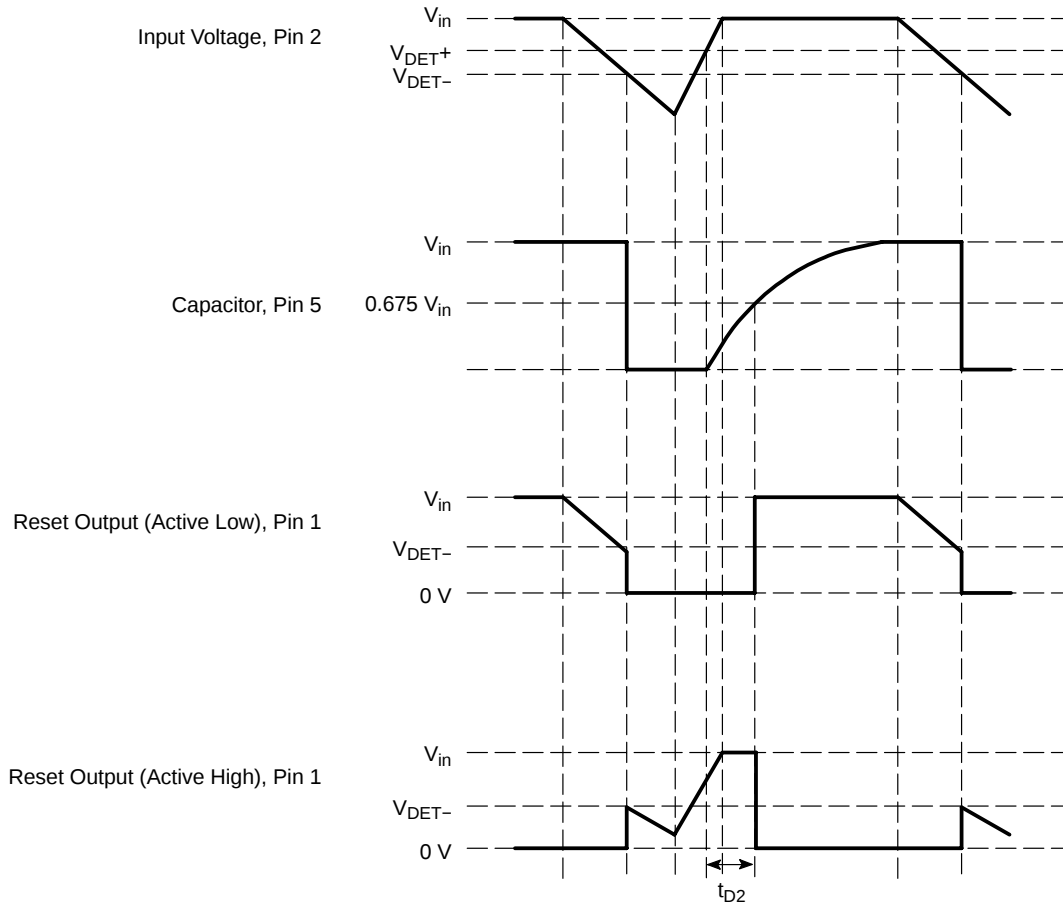


Figure 37. Timing Waveforms

NCP302, NCP303

APPLICATION CIRCUIT INFORMATION

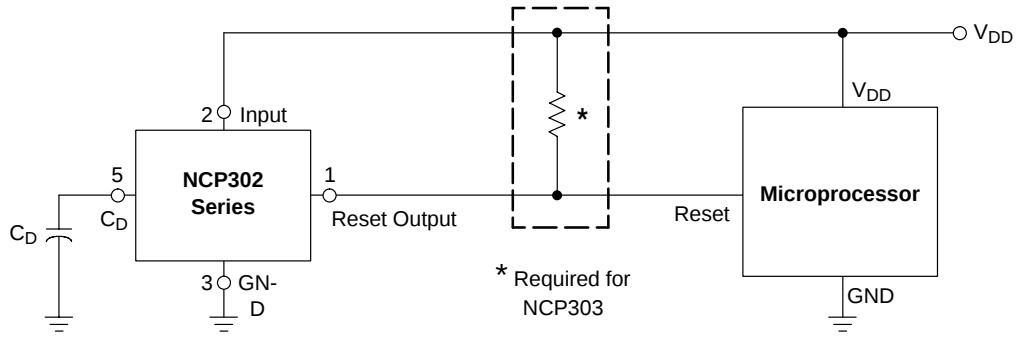


Figure 38. Microprocessor Reset Circuit

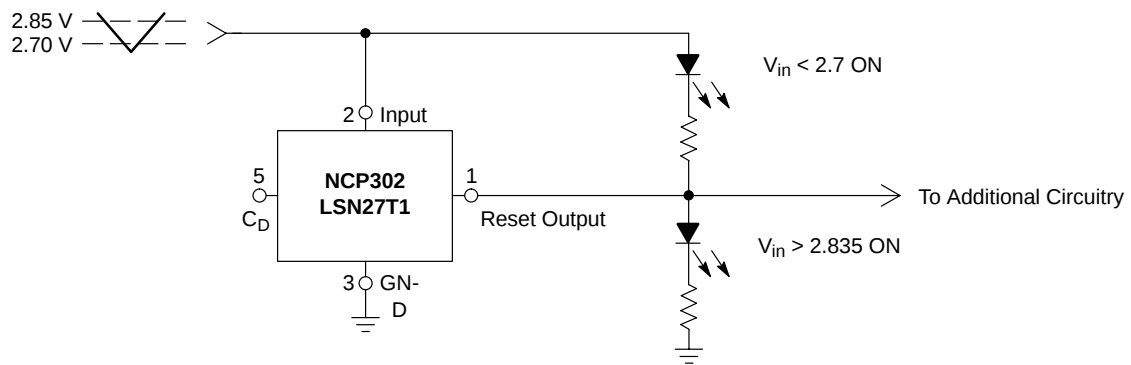


Figure 39. Battery Charge Indicator

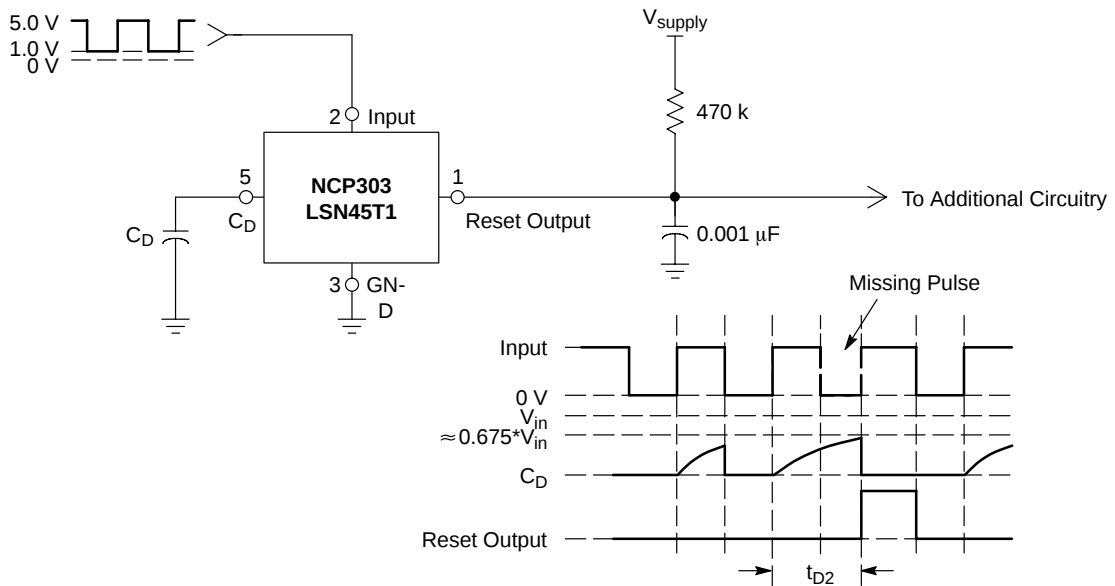


Figure 40. Missing Pulse Detector or Frequency Detector

NCP302, NCP303

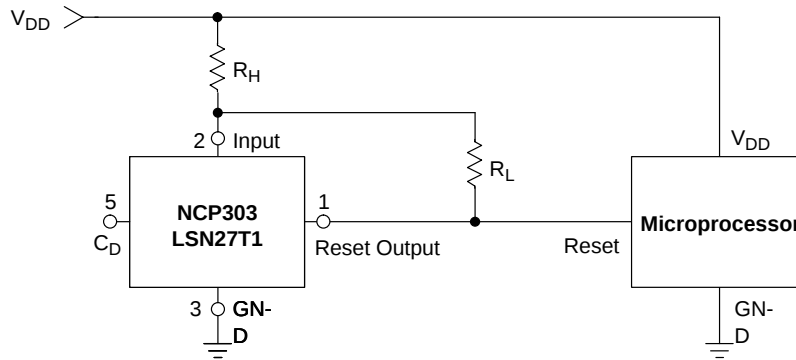


Figure 41. Microprocessor Reset Circuit with Additional Hysteresis

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

V_{in} Decreasing:

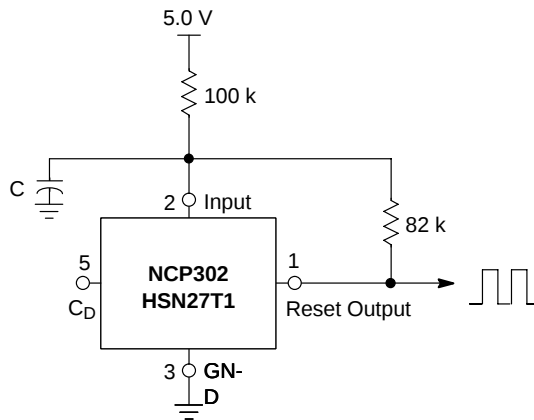
$$V_{th} = \left(\frac{R_H}{R_{in}} + 1 \right) (V_{DET-})$$

V_{in} Increasing:

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

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

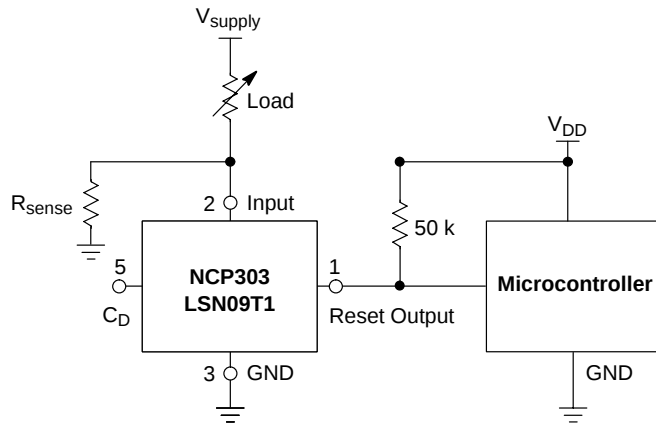
Test Data				
V_{th} Decreasing (V)	V_{th} Increasing (V)	V_{HYS} (V)	R_H (Ω)	R_L (k Ω)
2.70	2.84	0.135	0	–
2.70	2.87	0.17	100	10
2.70	2.88	0.19	100	6.8
2.70	2.91	0.21	100	4.3
2.70	2.90	0.20	220	10
2.70	2.94	0.24	220	6.8
2.70	2.98	0.28	220	4.3
2.70	2.70	0.27	470	10
2.70	3.04	0.34	470	6.8
2.70	3.15	0.35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

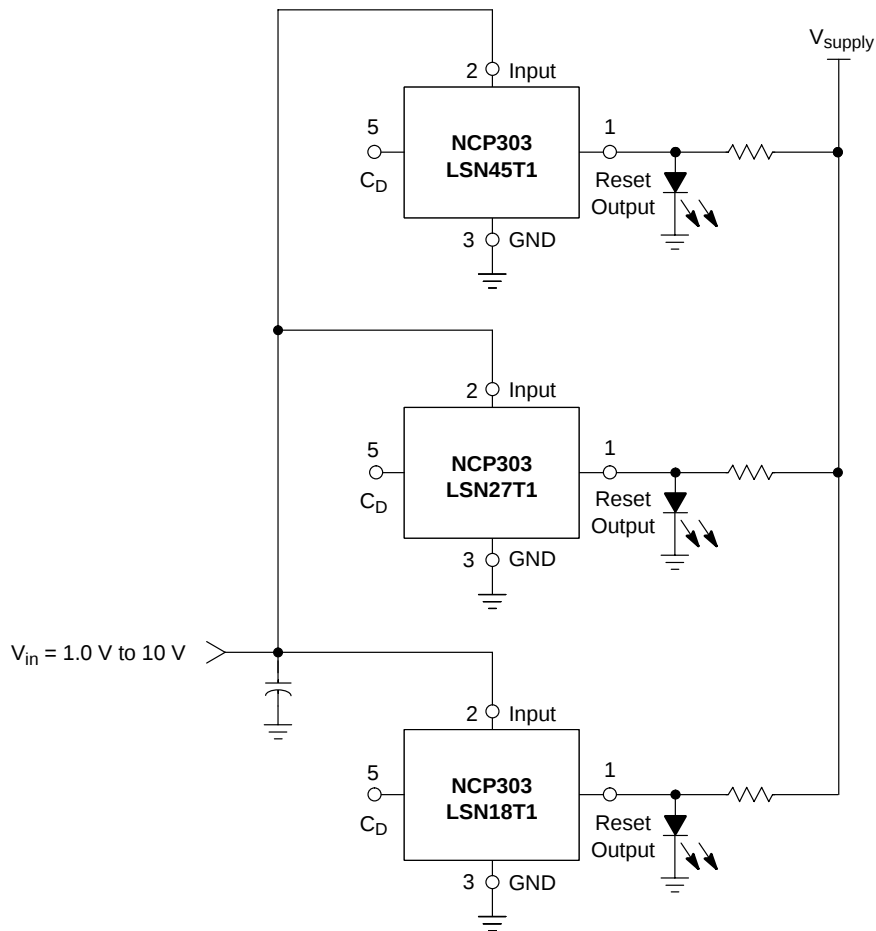
NCP302, NCP303



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:	Then:
$I_{Load} < V_{DET-} / R_{sense}$	Reset Output = 0 V
$I_{Load} \geq (V_{DET-} + V_{HYS}) / R_{sense}$	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

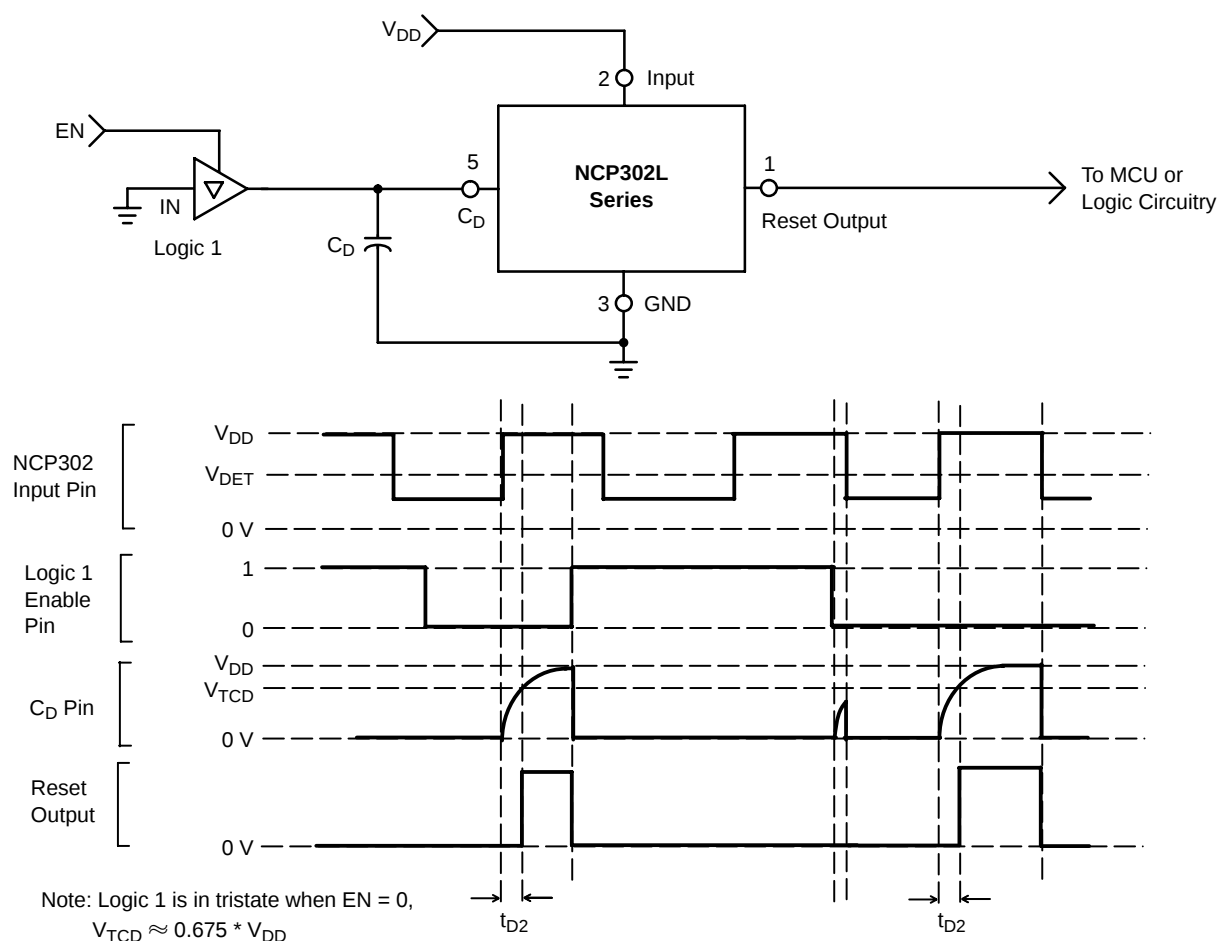


Figure 45. Undervoltage Detection with Independent Reset Signal Control

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

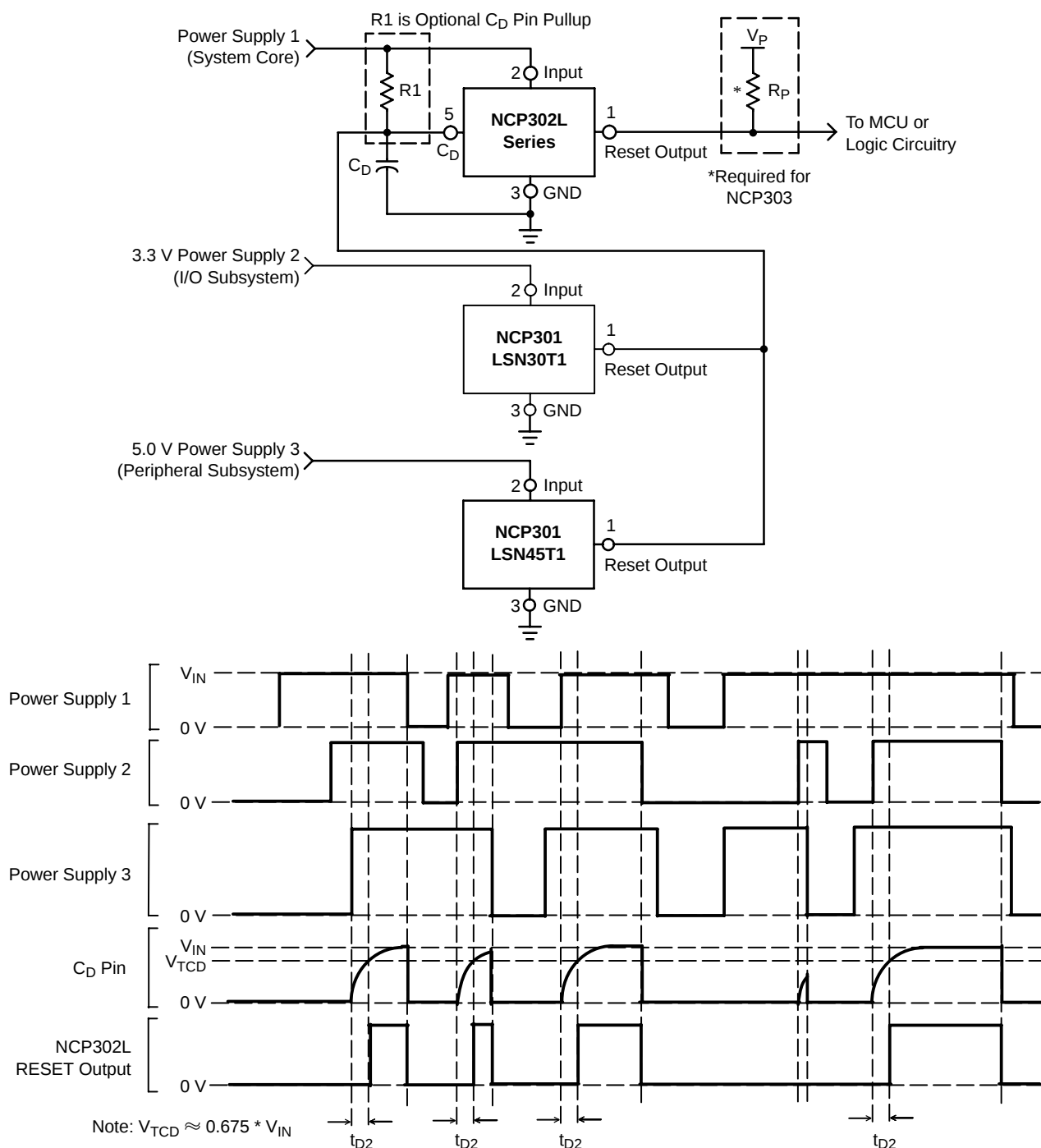


Figure 46. Multi-Rail Supply Undervoltage Monitor with Power Good

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 $1.0 \text{ M}\Omega$, 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.

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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	
NCP302LSN15T1G	1.5			SBI	TSOP-5 (Pb-Free)	
NCP302LSN18T1	1.8			SBF	TSOP-5	
NCP302LSN18T1G	1.8			SBF	TSOP-5 (Pb-Free)	
NCP302LSN20T1	2.0			SBD	TSOP-5	
NCP302LSN20T1G	2.0			SBD	TSOP-5 (Pb-Free)	
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	
NCP302LSN38T1G	3.8			SAK	TSOP-5 (Pb-Free)	
NCP302LSN40T1	4.0			SAI	TSOP-5	
NCP302LSN40T1G	4.0			SAI	TSOP-5 (Pb-Free)	
NCP302LSN43T1	4.3			SAF	TSOP-5	
NCP302LSN43T1G	4.3			SAF	TSOP-5 (Pb-Free)	
NCP302LSN45T1	4.5			SAL	TSOP-5	
NCP302LSN45T1G	4.5			SAL	TSOP-5 (Pb-Free)	
NCP302LSN47T1	4.7			SAC	TSOP-5	
NCP302LSN47T1G	4.7			SAC	TSOP-5 (Pb-Free)	
NCP302HSN09T1	0.9	CMOS	Active High	SDO	TSOP-5	3000 / Tape & Reel (7 inch Reel)
NCP302HSN09T1G	0.9			SDO	TSOP-5 (Pb-Free)	
NCP302HSN18T1	1.8			SFH	TSOP-5	
NCP302HSN18T1G	1.8			SFH	TSOP-5 (Pb-Free)	
NCP302HSN27T1	2.7			SDK	TSOP-5	
NCP302HSN27T1G	2.7			SDK	TSOP-5 (Pb-Free)	

NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and 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.

*NCV prefix for automotive and other applications requiring site and control changes.

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

NCP302, NCP303

ORDERING INFORMATION

Device	Threshold Voltage	Output Type	Reset	Marking	Package	Shipping [†]
NCP302HSN30T1	3.0	CMOS	Active High	SDI	TSOP-5	3000 / Tape & Reel (7 inch Reel)
NCP302HSN30T1G	3.0			SDI	TSOP-5 (Pb-Free)	
NCP302HSN40T1	4.0			SJH	TSOP-5	
NCP302HSN40T1G	4.0			SJH	TSOP-5 (Pb-Free)	
NCP302HSN45T1	4.5			SDG	TSOP-5	
NCP302HSN45T1G	4.5			SDG	TSOP-5 (Pb-Free)	
NCP303LSN09T1	0.9	Open Drain	Active Low	SDE	TSOP-5	3000 / Tape & Reel (7 inch Reel)
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	
NCP303LSN11T1G	1.1			SDC	TSOP-5 (Pb-Free)	
NCP303LSN13T1	1.3			SDA	TSOP-5	
NCP303LSN13T1G	1.3			SDA	TSOP-5 (Pb-Free)	
NCP303LSN14T1	1.4			SCZ	TSOP-5	
NCP303LSN14T1G	1.4			SCZ	TSOP-5 (Pb-Free)	
NCP303LSN15T1	1.5			SCY	TSOP-5	
NCP303LSN15T1G	1.5			SCY	TSOP-5 (Pb-Free)	
NCP303LSN16T1	1.6			SCX	TSOP-5	
NCP303LSN16T1G	1.6			SCX	TSOP-5 (Pb-Free)	
NCP303LSN18T1	1.8			SCV	TSOP-5	
NCP303LSN18T1G	1.8			SCV	TSOP-5 (Pb-Free)	
NCP303LSN20T1	2.0			SCT	TSOP-5	
NCP303LSN20T1G	2.0			SCT	TSOP-5 (Pb-Free)	
NCP303LSN22T1	2.2			SCR	TSOP-5	
NCP303LSN22T1G	2.2			SCR	TSOP-5 (Pb-Free)	

NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and 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.

*NCV prefix for automotive and other applications requiring site and control changes.

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

NCP302, NCP303

ORDERING INFORMATION

Device	Threshold Voltage	Output Type	Reset	Marking	Package	Shipping [†]
NCP303LSN23T1	2.3	Open Drain	Active Low	SCQ	TSOP-5	3000 / Tape & Reel (7 inch Reel)
NCP303LSN23T1G	2.3			SCQ	TSOP-5 (Pb-Free)	
NCP303LSN24T1	2.4			SCP	TSOP-5	
NCP303LSN24T1G	2.4			SCP	TSOP-5 (Pb-Free)	
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)	
NCV303LSN30T1*	3.0			SSA	TSOP-5	
NCV303LSN30T1G*	3.0			SSA	TSOP-5 (Pb-Free)	
NCP303LSN31T1	3.1			SCI	TSOP-5	
NCP303LSN31T1G	3.1			SCI	TSOP-5 (Pb-Free)	
NCP303LSN32T1	3.2			SCH	TSOP-5	
NCP303LSN32T1G	3.2			SCH	TSOP-5 (Pb-Free)	
NCP303LSN33T1	3.3			SCG	TSOP-5	
NCP303LSN33T1G	3.3			SCG	TSOP-5 (Pb-Free)	
NCP303LSN34T1	3.4			SCF	TSOP-5	
NCP303LSN34T1G	3.4			SCF	TSOP-5 (Pb-Free)	
NCP303LSN36T1	3.6			SCD	TSOP-5	
NCP303LSN36T1G	3.6			SCD	TSOP-5 (Pb-Free)	

NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and 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.

*NCV prefix for automotive and other applications requiring site and control changes.

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

NCP302, NCP303

ORDERING INFORMATION

Device	Threshold Voltage	Output Type	Reset	Marking	Package	Shipping [†]
NCP303LSN38T1	3.8	Open Drain	Active Low	SCA	TSOP-5	3000 / Tape & Reel (7 inch Reel)
NCP303LSN38T1G	3.8			SCA	TSOP-5 (Pb-Free)	
NCP303LSN40T1	4.0			SBY	TSOP-5	
NCP303LSN40T1G	4.0			SBY	TSOP-5 (Pb-Free)	
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)	
NCV303LSN44T1*	4.4			SSF	TSOP-5	
NCV303LSN44T1G*	4.4			SSF	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	
NCP303LSN47T1G	4.7			SBR	TSOP-5 (Pb-Free)	
NCV303LSN47T1*	4.7			SSJ	TSOP-5	
NCV303LSN47T1G*	4.7			SSJ	TSOP-5 (Pb-Free)	
NCP303LSN49T1	4.9			SBP	TSOP-5	
NCV303LSN49T1*	4.9			SSI	TSOP-5	
NCV303LSN49T1G*	4.9			SSI	TSOP-5 (Pb-Free)	

NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and 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.

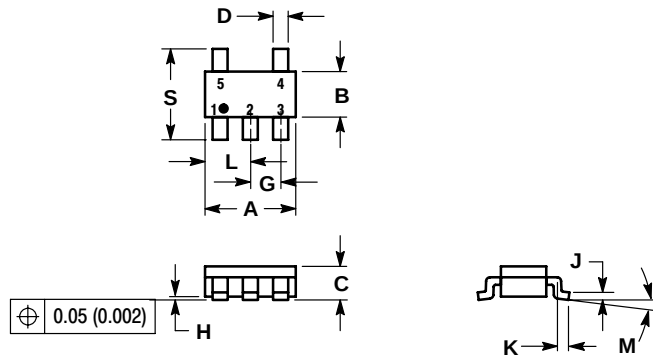
*NCV prefix for automotive and other applications requiring site and control changes.

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

NCP302, NCP303

PACKAGE DIMENSIONS

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

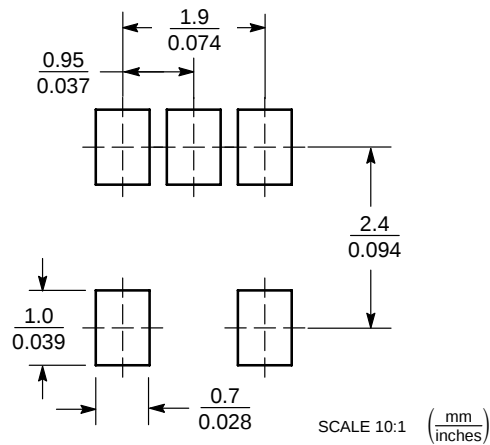


NOTES:

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
E	0.85	1.05	0.0335	0.0413
F	0.013	0.100	0.0005	0.0040
G	0.10	0.26	0.0040	0.0102
H	0.20	0.60	0.0079	0.0236
J	1.25	1.55	0.0493	0.0610
K	0	10	0	10
L	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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