Voltage Detector Series

NCP300, NCP301

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

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

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

The NCP300 and NCP301 device series are available in the Thin TSOP−5 package with standard undervoltage thresholds. Additional thresholds that range from 0.9 V to 4.9 V in 100 mV steps can be manufactured.

Features

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

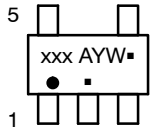
Typical Applications

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

MARKING DIAGRAM



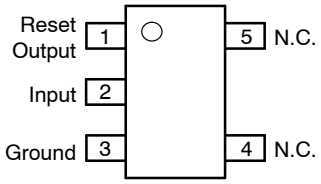
TSOP−5/
SOT23−5
CASE 483



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

(Note:Microdot may be in either location)

PIN CONNECTIONS



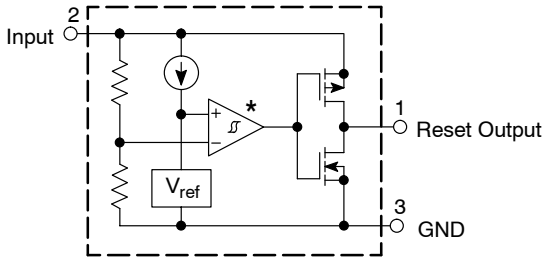
(Top View)

ORDERING INFORMATION

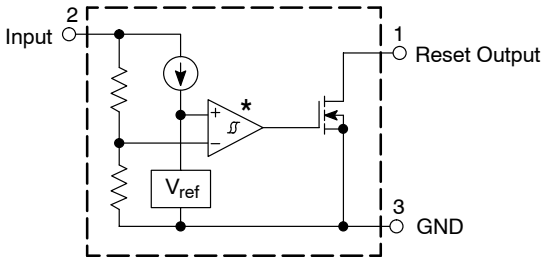
See detailed ordering and shipping information in the ordering information section on page 21 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 21.

NCP300xSNxxT1
Complementary Output Configuration



NCP301xSNxxT1
Open Drain Output Configuration



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

This device contains 25 active transistors.

Figure 1. Representative Block Diagrams

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MAXIMUM RATINGS

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

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

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

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

3. Maximum ratings per JEDEC standard JESD78.

ELECTRICAL CHARACTERISTICS (For all values T_A = −40°C to +125°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
NCP300/1 − 0.9 / NCV300/1 − 0.9 (T_A = 25°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 V) (V_{in} = 2.9 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°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)	I_{OUT}				mA
N−Channel Sink Current, NCP300, NCP301 (V_{OUT} = 0.05 V, V_{in} = 0.70 V) (V_{OUT} = 0.50 V, V_{in} = 0.85 V)		 0.01 0.05	 0.05 0.50	 – –	
P−Channel Source Current, NCP300 (V_{OUT} = 2.4 V, V_{in} = 4.5 V)		 1.0	 6.0	 –	
Reset Output Current (Pin 1, Active High 'H' Suffix Devices)	I_{OUT}				mA
N−Channel Sink Current, NCP300, NCP301 (V_{OUT} = 0.5 V, V_{in} = 1.5 V)		 1.05	 2.5	 –	
P−Channel Source Current, NCP300 (V_{OUT} = 0.4 V, V_{in} = 0.7 V) (V_{OUT} = GND, V_{in} = 0.8 V)		 0.011 0.014	 0.04 0.08	 – –	
Propagation Delay Input to Output (Figure 2)					μs
Complementary Output NCP300 Series Output Transition, High to Low Output Transition, Low to High	 t_{pHL} t_{pLH}	 – –	 97 77	 – 300	
N−Channel Open Drain NCP301 Series Output Transition, High to Low Output Transition, Low to High	 t_{pHL} t_{pLH}	 – –	 97 –	 – 300	
NCP300/1 − 1.8 / NCV300/1 − 1.8					
Detector Threshold (Pin 2, V_{in} Decreasing) (T_A = 25°C) (T_A = −40°C to 125°C)	V_{DET-}	1.764 1.746	1.80 –	1.836 1.854	V
Detector Threshold Hysteresis (Pin 2, V_{in} Increasing)	V_{HYS}	0.054	0.090	0.126	V
Supply Current (Pin 2) (V_{in} = 1.7 V) (V_{in} = 3.8 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°C) (T_A = −40°C to 125°C)	$V_{in(min)}$	– –	0.55 0.65	0.70 0.80	V
Reset Output Current (Pin 1, Active Low 'L' Suffix Devices)	I_{OUT}				mA
N−Channel Sink Current, NCP300, NCP301 (V_{OUT} = 0.05V, V_{in} = 0.70 V) (V_{OUT} = 0.50V, V_{in} = 1.5 V)		 0.01 1.0	 0.05 2.0	 – –	
P−Channel Source Current, NCP300 (V_{OUT} = 2.4 V, V_{in} = 4.5 V)		 1.0	 6.0	 –	
Reset Output Current (Pin 1, Active High 'H' Suffix Devices)	I_{OUT}				mA
N−Channel Sink Current, NCP300, NCP301 (V_{OUT} = 0.5 V, V_{in} = 5.0 V)		 6.3	 11	 –	
P−Channel Source Current, NCP300 (V_{OUT} = 0.4 V, V_{in} = 0.7 V) (V_{OUT} = GND, V_{in} = 1.5 V)		 0.011 0.525	 0.04 0.6	 – –	
Propagation Delay Input to Output (Figure 2)					μs
Complementary Output NCP300 Series Output Transition, High to Low Output Transition, Low to High	 t_{pHL} t_{pLH}	 – –	 73 94	 – 300	

ELECTRICAL CHARACTERISTICS (continued) (For all values T_A = −40°C to +125°C, unless otherwise noted.)

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

ELECTRICAL CHARACTERISTICS (continued) (For all values T_A = −40°C to +125°C, unless otherwise noted.)

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

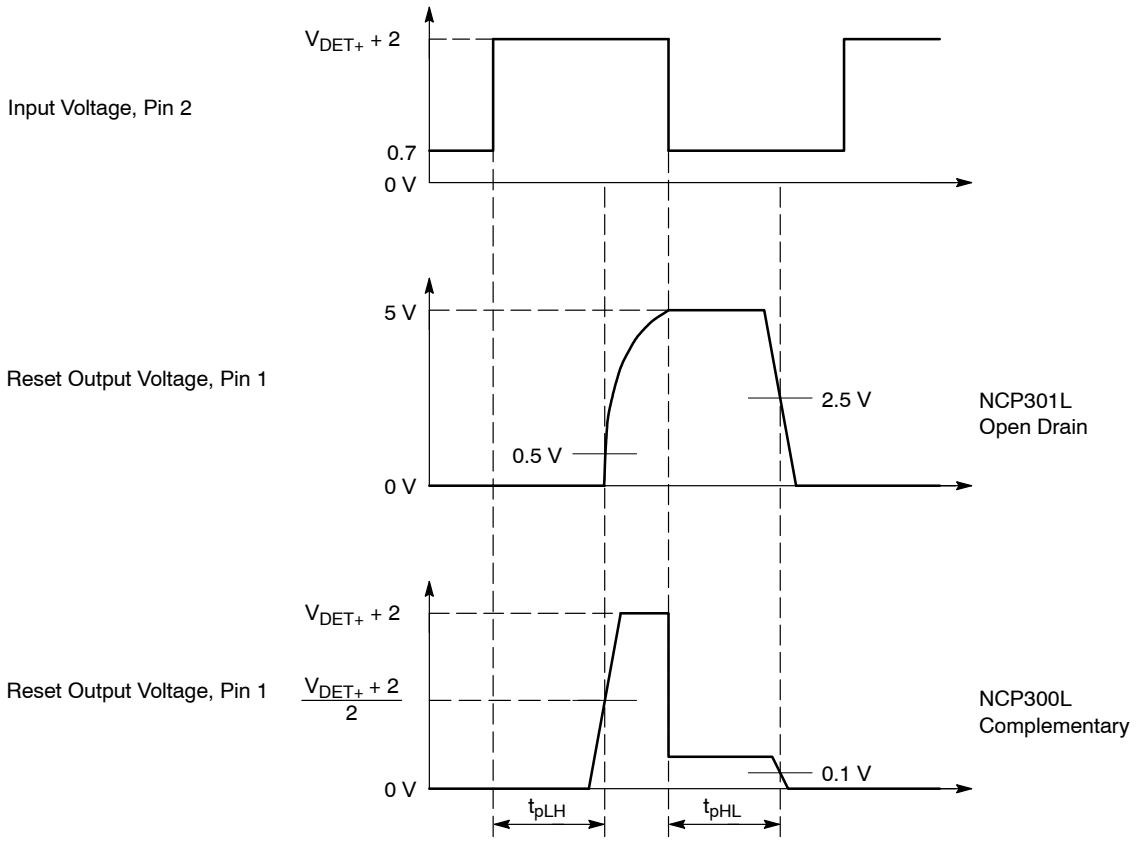
ELECTRICAL CHARACTERISTICS (continued) (For all values T_A = −40°C to +125°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
NCP300/1− 2.8 / NCV300/1− 2.8					
P−Channel Source Current, NCP300 (V_{OUT} = 2.4V, V_{in} = 4.5V)		1.0	9.7	−	
Reset Output Current (Pin 1, Active High 'H' Suffix Devices)	I_{OUT}				mA
N−Channel Sink Current, NCP300, NCP301 (V_{OUT} = 0.5 V, V_{in} = 5.0 V)		6.3	11	−	
P−Channel Source Current, NCP300 (V_{OUT} = 0.4 V, V_{in} = 0.7 V) (V_{OUT} = GND, V_{in} = 1.5 V)		0.011 0.525	0.04 0.6	− −	
Propagation Delay Input to Output (Figure 2)					µs
Complementary Output NCP300 Series Output Transition, High to Low Output Transition, Low to High	 t_{pHL} t_{pLH}	 − −	 55 115	 − 300	
N−Channel Open Drain NCP301 Series Output Transition, High to Low Output Transition, Low to High	 t_{pHL} t_{pLH}	 − −	 55 −	 − 300	
NCP300/1 − 3.0 / NCV300/1 − 3.0					
Detector Threshold (Pin 2, V_{in} Decreasing) (T_A = 25°C) (T_A = −40°C to 125°C)	V_{DET-}	2.94 2.91	3.00 −	3.06 3.09	V
Detector Threshold Hysteresis (Pin 2, V_{in} Increasing)	V_{HYS}	0.09	0.15	0.21	V
Supply Current (Pin 2) (V_{in} = 2.87 V) (V_{in} = 5.0 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°C) (T_A = −40°C to 125°C)	$V_{in(min)}$	− −	0.55 0.65	0.70 0.80	V
Reset Output Current (Pin 1, Active Low 'L' Suffix Devices)	I_{OUT}				mA
N−Channel Sink Current, NCP300, NCP301 (V_{OUT} = 0.05V, V_{in} = 0.70V) (V_{OUT} = 0.50V, V_{in} = 1.5V)		 0.01 1.0	 0.14 3.5	 − −	
P−Channel Source Current, NCP300 (V_{OUT} = 2.4V, V_{in} = 4.5V)		1.0	9.7	−	
Reset Output Current (Pin 1, Active High 'H' Suffix Devices)	I_{OUT}				mA
N−Channel Sink Current, NCP300, NCP301 (V_{OUT} = 0.5 V, V_{in} = 5.0 V)		6.3	11	−	
P−Channel Source Current, NCP300 (V_{OUT} = 0.4 V, V_{in} = 0.7 V) (V_{OUT} = GND, V_{in} = 1.5 V)		0.011 0.525	0.04 0.6	− −	
Propagation Delay Input to Output (Figure 2)					µs
Complementary Output NCP300 Series Output Transition, High to Low Output Transition, Low to High	 t_{pHL} t_{pLH}	 − −	 49 115	 − 300	
N−Channel Open Drain NCP301 Series Output Transition, High to Low Output Transition, Low to High	 t_{pHL} t_{pLH}	 − −	 49 −	 − 300	
NCP300/1 − 4.5 / NCV300/1 − 4.5					
Detector Threshold (Pin 2, V_{in} Decreasing) (T_A = 25°C) (T_A = −40°C to 125°C)	V_{DET-}	4.410 4.365	4.500 −	4.590 4.635	V
Detector Threshold Hysteresis (Pin 2, V_{in} Increasing)	V_{HYS}	0.135	0.225	0.315	V
Supply Current (Pin 2) (V_{in} = 4.34 V) (V_{in} = 6.5 V)	I_{in}	 − −	 0.33 0.52	 1.0 1.4	µA
Maximum Operating Voltage (Pin 2)	$V_{in(max)}$	−	−	10	V

ELECTRICAL CHARACTERISTICS (continued) (For all values T_A = −40°C to +125°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
NCP300/1 − 4.5 / NCV300/1 − 4.5					
Minimum Operating Voltage (Pin 2) (T_A = 25°C) (T_A = −40°C to 125°C)	$V_{in(min)}$	− −	0.55 0.65	0.70 0.80	V
Reset Output Current (Pin 1, Active Low 'L' Suffix Devices)	I_{OUT}				mA
N−Channel Sink Current, NCP300, NCP301 (V_{OUT} = 0.05V, V_{in} = 0.70V) (V_{OUT} = 0.50V, V_{in} = 1.5V)		 0.01 1.0	 0.05 2.0	 − −	
P−Channel Source Current, NCP300 (V_{OUT} = 5.9V, V_{in} = 8.0V)		 1.5	 10.5	 −	
Reset Output Current (Pin 1, Active High 'H' Suffix Devices)	I_{OUT}				mA
N−Channel Sink Current, NCP300, NCP301 (V_{OUT} = 0.5 V, V_{in} = 5.0 V)		 6.3	 11	 −	
P−Channel Source Current, NCP300 (V_{OUT} = 0.4 V, V_{in} = 0.7 V) (V_{OUT} = GND, V_{in} = 1.5 V)		 0.011 0.525	 0.04 0.6	 − −	
Propagation Delay Input to Output (Figure 2)					μs
Complementary Output NCP300 Series Output Transition, High to Low Output Transition, Low to High	 t_{pHL} t_{pLH}	 − −	 49 130	 − 300	
N−Channel Open Drain NCP301 Series Output Transition, High to Low Output Transition, Low to High	 t_{pHL} t_{pLH}	 − −	 49 −	 − 300	
NCP300/1 − 4.7 / NCV300/1 − 4.7					
Detector Threshold (Pin 2, V_{in} Decreasing) (T_A = 25°C) (T_A = −40°C to 125°C)	V_{DET-}	4.606 4.559	4.700 −	4.794 4.841	V
Detector Threshold Hysteresis (Pin 2, V_{in} Increasing)	V_{HYS}	0.141	0.235	0.329	V
Supply Current (Pin 2) (V_{in} = 4.54 V) (V_{in} = 6.7 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°C) (T_A = −40°C to 125°C)	$V_{in(min)}$	− −	0.55 0.65	0.70 0.80	V
Reset Output Current (Pin 1, Active Low 'L' Suffix Devices)	I_{OUT}				mA
N−Channel Sink Current, NCP300, NCP301 (V_{OUT} = 0.05V, V_{in} = 0.70V) (V_{OUT} = 0.50V, V_{in} = 1.5V)		 0.01 1.0	 0.05 2.0	 − −	
P−Channel Source Current, NCP300 (V_{OUT} = 5.9V, V_{in} = 8.0V)		 1.5	 10.5	 −	
Reset Output Current (Pin 1, Active High 'H' Suffix Devices)	I_{OUT}				mA
N−Channel Sink Current, NCP300, NCP301 (V_{OUT} = 0.5 V, V_{in} = 5.0 V)		 6.3	 11	 −	
P−Channel Source Current, NCP300 (V_{OUT} = 0.4 V, V_{in} = 0.7 V) (V_{OUT} = GND, V_{in} = 1.5 V)		 0.011 0.525	 0.04 0.6	 − −	
Propagation Delay Input to Output (Figure 2)					μs
Complementary Output NCP300 Series Output Transition, High to Low Output Transition, Low to High	 t_{pHL} t_{pLH}	 − −	 45 130	 − 300	
N−Channel Open Drain NCP301 Series Output Transition, High to Low Output Transition, Low to High	 t_{pHL} t_{pLH}	 − −	 45 −	 − 300	

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



NCP300 and NCP301 series are measured with a 10 pF capacitive load. NCP301 has an additional 470 k pull−up resistor connected from the reset output to +5.0 V. The reset output voltage waveforms are shown for the active low 'L' devices. The upper detector threshold, V_{DET+} is the sum of the lower detector threshold, V_{DET-} plus the input hysteresis, V_{HYS}.

Figure 2. Propagation Delay Measurement Conditions

Table 1. ELECTRICAL CHARACTERISTIC TABLE FOR 0.9 – 4.9 V

NCP300 Series	Detector Threshold			Detector Threshold Hysteresis			Supply Current		Nch Sink Current		Pch Source Current
							V_{in} Low	V_{in} High	V_{in} Low	V_{in} High	
	V_{DET-} (V) (Note 4)			V_{HYS} (V)			I_{in} (μA) (Note 5)	I_{in} (μA) (Note 6)	I_{OUT} (mA) (Note 7)	I_{OUT} (mA) (Note 8)	I_{OUT} (mA) (Note 9)
Part Number	Min	Typ	Max	Min	Typ	Max	Typ	Typ	Typ	Typ	Typ
NCP300LSN09T1	0.882	0.9	0.918	0.027	0.045	0.063	0.20	0.45	0.05	0.5	2.0
NCP300LSN18T1	1.764	1.8	1.836	0.054	0.090	0.126	0.23	0.48			
NCP300LSN185T1	1.813	1.85	1.887	0.056	0.093	0.130					
NCP300LSN20T1	1.960	2.0	2.040	0.060	0.100	0.140					
NCP300LSN25T1	2.45	2.5	2.55	0.075	0.125	0.175	0.25	0.50			
NCP300LSN27T1	2.646	2.7	2.754	0.081	0.135	0.189	0.25	0.50			
NCP300LSN28T1	2.744	2.8	2.856	0.084	0.140	0.196					
NCP300LSN30T1	2.940	3.0	3.060	0.090	0.150	0.210					
NCP300LSN33T1	3.234	3.3	3.366	0.099	0.165	0.231					
NCP300LSN34T1	3.332	3.4	3.468	0.102	0.170	0.238					
NCP300LSN44T1	4.312	4.4	4.488	0.132	0.220	0.308					
NCP300LSN45T1	4.410	4.5	4.590	0.135	0.225	0.315	0.33	0.52			
NCP300LSN46T1	4.508	4.6	4.692	0.138	0.230	0.322					
NCP300LSN47T1	4.606	4.7	4.794	0.141	0.235	0.329	0.34	0.53			

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

Table 2. ELECTRICAL CHARACTERISTIC TABLE FOR 0.9 – 4.9 V

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

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

Table 3. ELECTRICAL CHARACTERISTIC TABLE FOR 0.9 – 4.9 V

NCP301 Series	Detector Threshold			Detector Threshold Hysteresis			Supply Current		Nch Sink Current	
							V_{in} Low	V_{in} High	V_{in} Low	V_{in} High
	V_{DET-} (V) (Note 16)			V_{HYS} (V)			I_{in} (μA) (Note 16)	I_{in} (μA) (Note 18)	I_{OUT} (mA) (Note 19)	I_{OUT} (mA) (Note 20)
Part Number	Min	Typ	Max	Min	Typ	Max	Typ	Typ	Typ	Typ
NCP301LSN09T1	0.882	0.9	0.918	0.027	0.045	0.063	0.20	0.45	0.05	0.5
NCP301LSN12T1	1.176	1.2	1.224	0.036	0.060	0.084				
NCP301LSN16T1	1.568	1.6	1.632	0.048	0.080	0.112				2.0
NCP301LSN18T1	1.764	1.8	1.836	0.054	0.090	0.126	0.23	0.48		
NCP301LSN20T1	1.960	2.0	2.040	0.060	0.100	0.140				
NCP301LSN22T1	2.156	2.2	2.244	0.066	0.110	0.154				
NCP301LSN24T1	2.352	2.4	2.448	0.072	0.120	0.168				
NCP301LSN25T1	2.450	2.5	2.550	0.075	0.125	0.175				
NCP301LSN26T1	2.548	2.6	2.652	0.078	0.130	0.182				
NCP301LSN27T1	2.646	2.7	2.754	0.081	0.135	0.189	0.25	0.50		
NCP301LSN28T1	2.744	2.8	2.856	0.084	0.140	0.196				
NCP301LSN30T1	2.940	3.0	3.060	0.090	0.150	0.210				
NCP301LSN31T1	3.038	3.1	3.162	0.093	0.155	0.217				
NCP301LSN32T1	3.136	3.2	3.264	0.096	0.160	0.224				
NCP301LSN33T1	3.234	3.3	3.366	0.099	0.165	0.231				
NCP301LSN34T1	3.332	3.4	3.468	0.102	0.170	0.238				
NCP301LSN36T1	3.528	3.6	3.672	0.108	0.180	0.252				
NCP301LSN40T1	3.920	4.0	4.080	0.120	0.200	0.280				
NCP301LSN42T1	4.116	4.2	4.284	0.126	0.210	0.294				
NCP301LSN45T1	4.410	4.5	4.590	0.135	0.225	0.315	0.33	0.52		
NCP301LSN46T1	4.508	4.6	4.692	0.138	0.230	0.322				
NCP301LSN47T1	4.606	4.7	4.794	0.141	0.235	0.329	0.34	0.53		

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

Table 4. ELECTRICAL CHARACTERISTIC TABLE FOR 0.9 – 4.9 V

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

21. Values shown apply at +25°C only. For voltage options greater than 1.1 V, V_{DET-} limits over operating temperature range (−40°C to +125°C) are V_{NOM} ±3%. For voltage options < 1.2 V, V_{DET-} is guaranteed only at +25°C.
22. Condition 1: 0.9 – 2.9 V, $V_{in} = V_{DET-} - 0.10$ V; 3.0 – 3.9 V, $V_{in} = V_{DET-} - 0.13$ V; 4.0 – 4.9 V, $V_{in} = V_{DET-} - 0.16$ V
23. Condition 2: 0.9 – 4.9 V, $V_{in} = V_{DET-} + 2.0$ V
24. Condition 3: 0.9 – 1.4 V, V_{in} = 1.5 V, V_{OUT} = 0.5 V; 1.5 – 4.9 V, V_{in} = 5.0 V, V_{OUT} = 0.5 V, Active High 'H' Suffix Devices

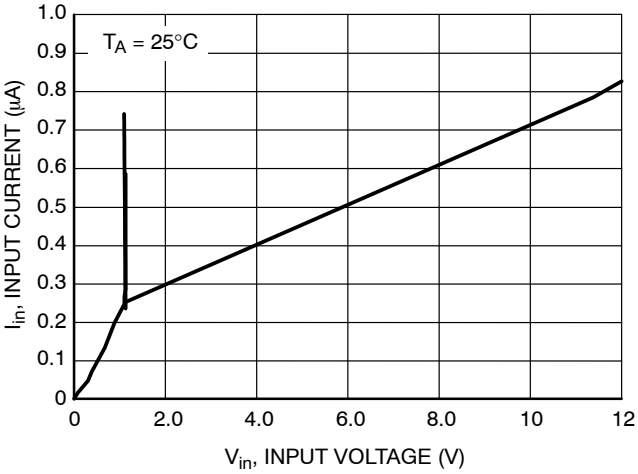


Figure 3. NCP300/1 Series 0.9 V Input Current versus Input Voltage

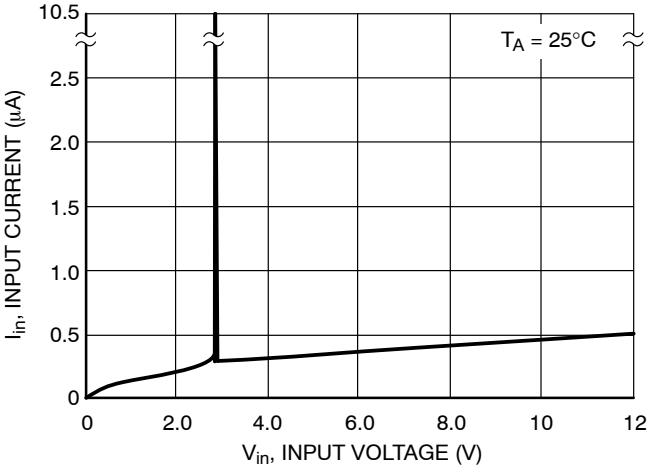


Figure 4. NCP300/1 Series 2.7 V Input Current versus Input Voltage

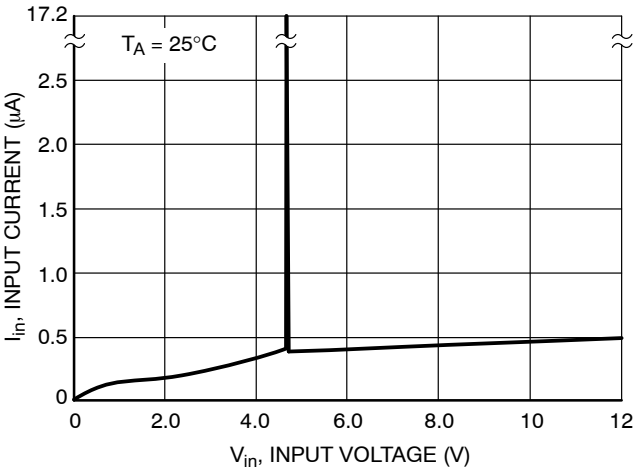


Figure 5. NCP300/1 Series 4.5 V Input Current versus Input Voltage

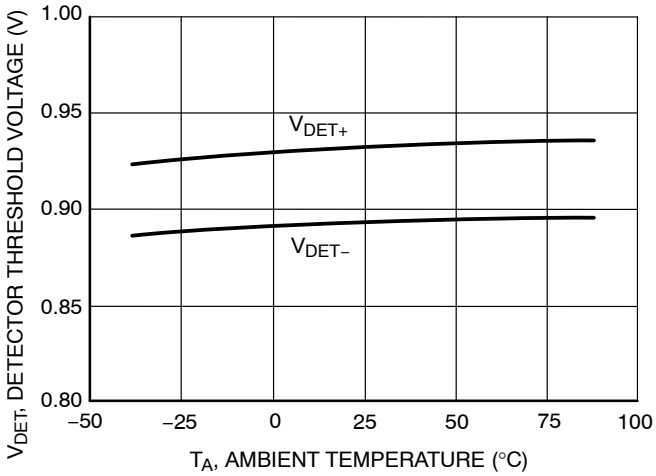


Figure 6. NCP300/1 Series 0.9 V Detector Threshold Voltage versus Temperature

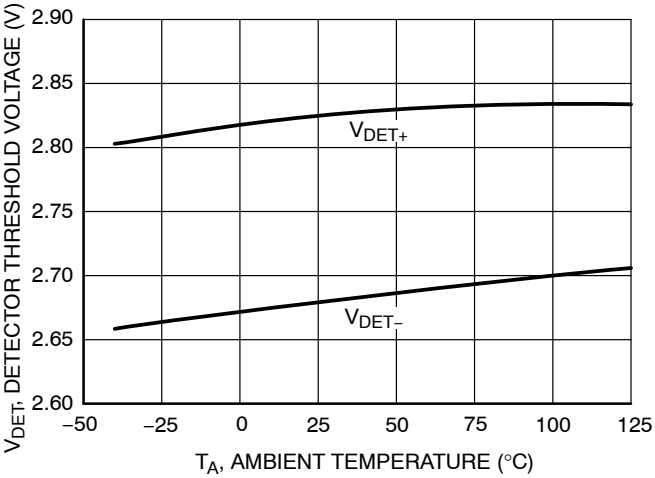


Figure 7. NCP300/1 Series 2.7 V Detector Threshold Voltage versus Temperature

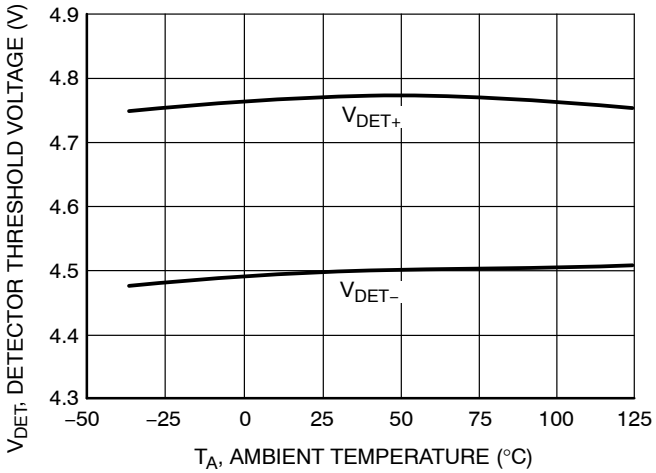


Figure 8. NCP300/1 Series 4.5 V Detector Threshold Voltage versus Temperature

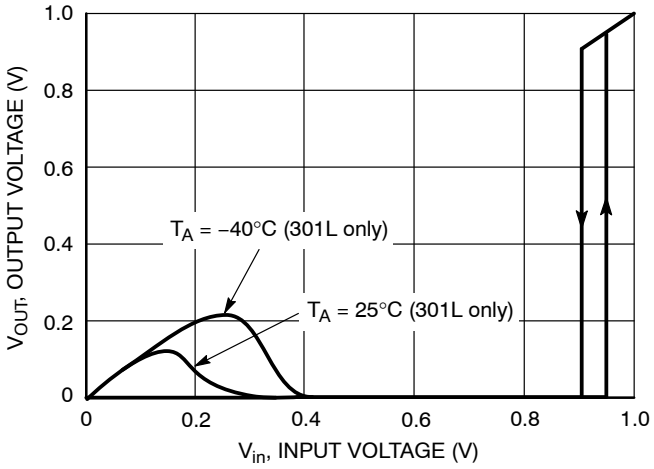


Figure 9. NCP300L/1L Series 0.9 V Reset Output Voltage versus Input Voltage

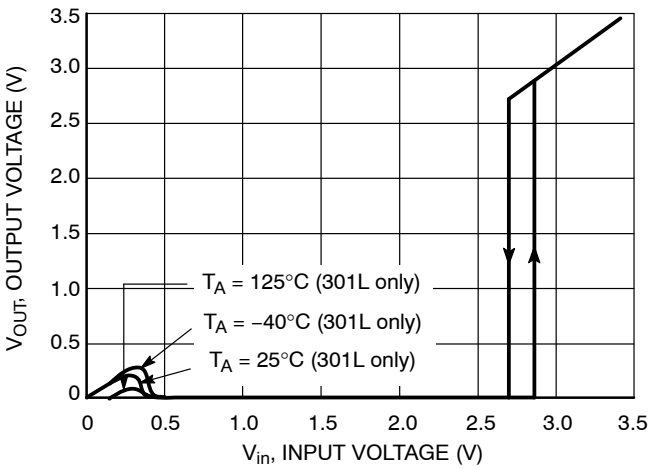


Figure 10. NCP300L/1L Series 2.7 V Reset Output Voltage versus Input Voltage

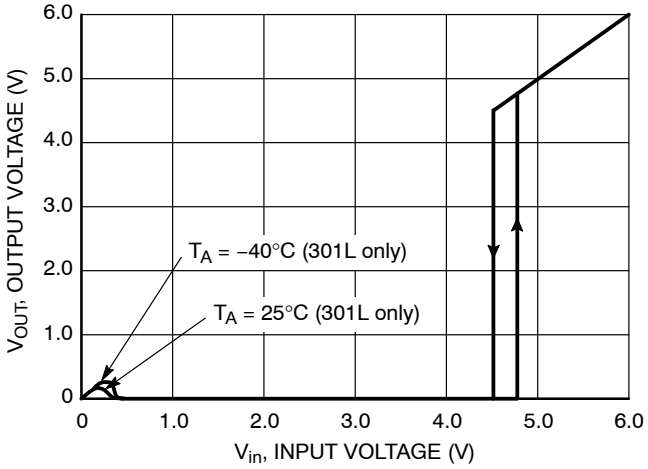


Figure 11. NCP300L/1L Series 4.5 V Reset Output Voltage versus Input Voltage

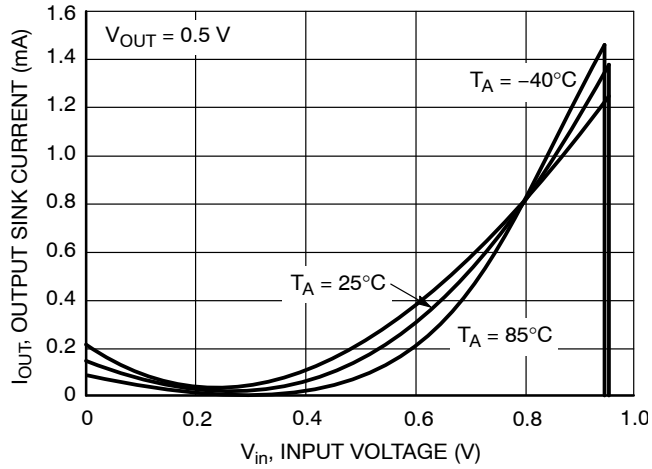


Figure 12. NCP300H/1L Series 0.9 V Reset Output Sink Current versus Input Voltage

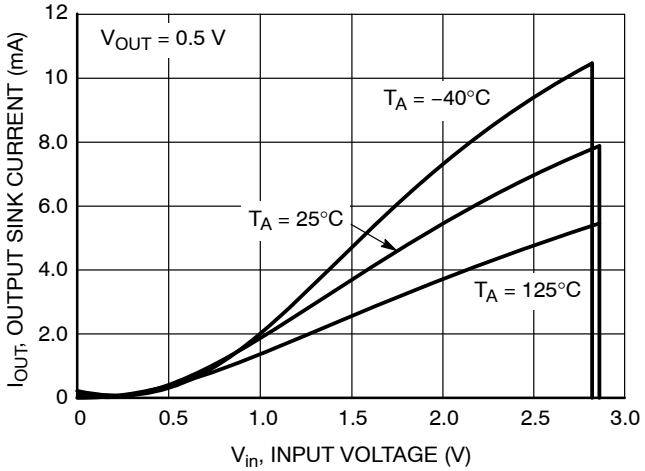


Figure 13. NCP300H/1L Series 2.7 V Reset Output Sink Current versus Input Voltage

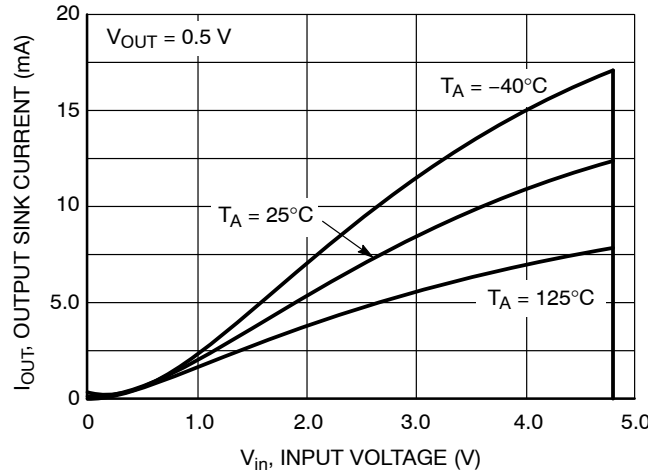


Figure 14. NCP300H/1L Series 4.5 V Reset Output Sink Current versus Input Voltage

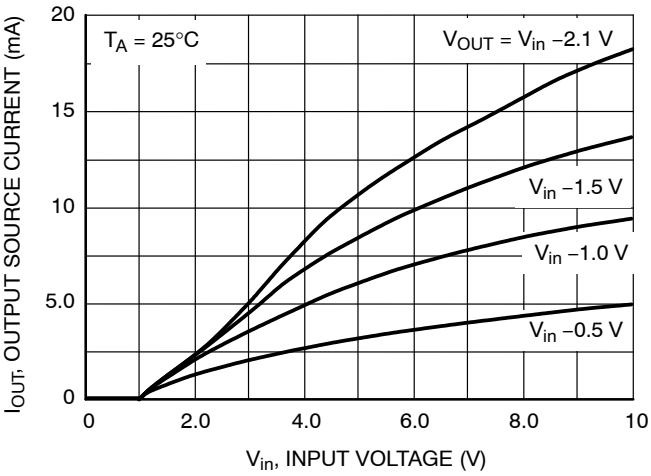


Figure 15. NCP300L Series 0.9 V Reset Output Source Current versus Input Voltage

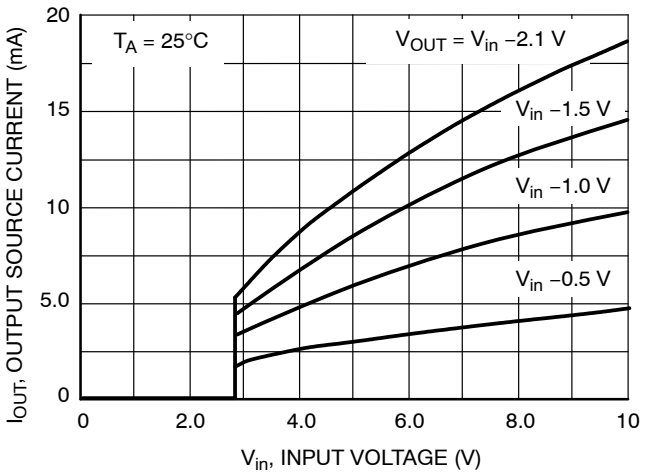


Figure 16. NCP300L Series 2.7 V Reset Output Source Current versus Input Voltage

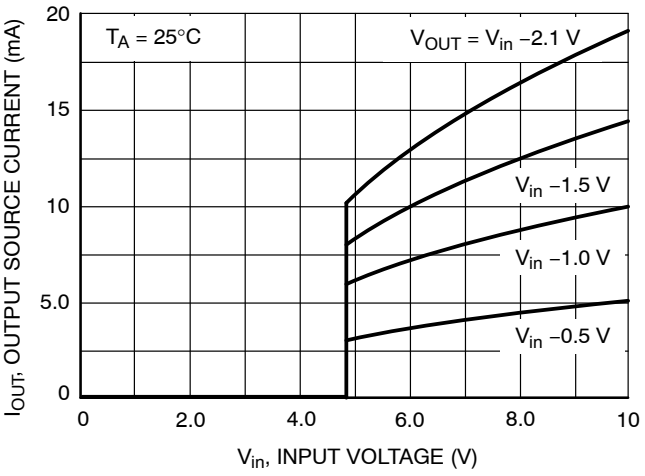


Figure 17. NCP300L Series 4.5 V Reset Output Source Current versus Input Voltage

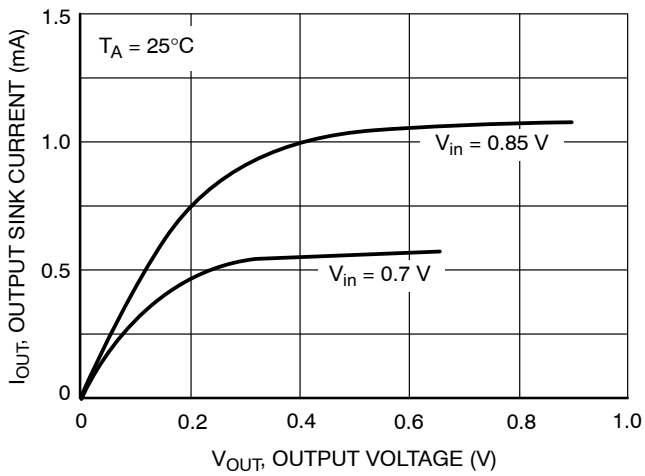


Figure 18. NCP300H/1L Series 0.9 V Reset Output Sink Current versus Output Voltage

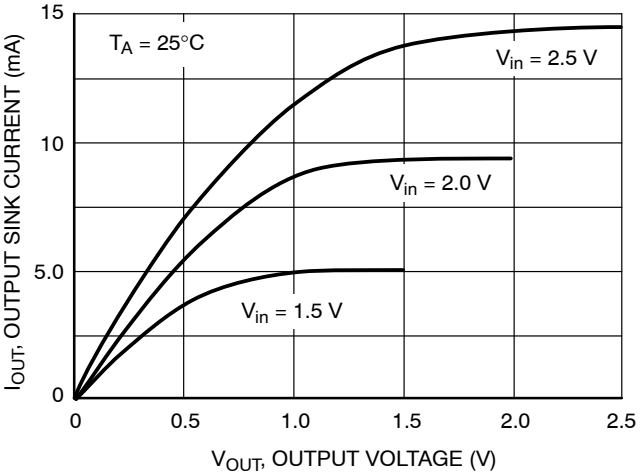


Figure 19. NCP300H/1L Series 2.7 V Reset Output Sink Current versus Output Voltage

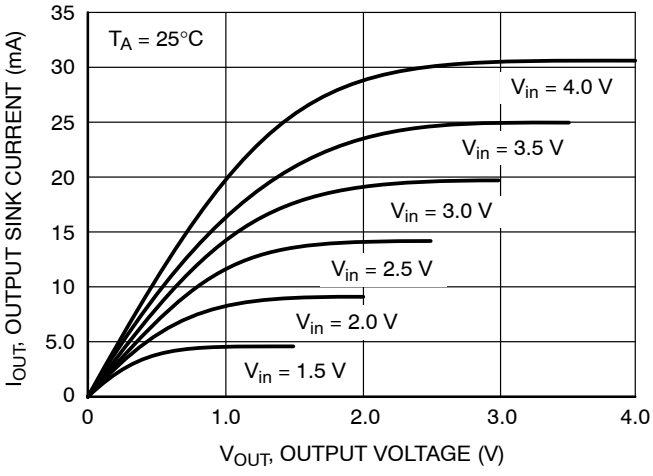


Figure 20. NCP300H/1L Series 4.5 V Reset Output Sink Current versus Output Voltage

OPERATING DESCRIPTION

The NCP300 and NCP301 series devices are second generation ultra−low current voltage detectors. Figures 20 and 21 show a timing diagram and a typical application. Initially consider that input voltage V_{in} is at a nominal level and it is greater than the voltage detector upper threshold (V_{DET+}), and the reset output (Pin 1) will be in the high state for active low devices, or in the low state for active high devices. If there is a power interruption and V_{in} becomes significantly deficient, it will fall below the lower detector threshold (V_{DET-}). This sequence of events causes the Reset output to be in the low state for active low devices, or in the high state for active high devices. After completion of the power interruption, V_{in} will again return to its nominal level and become greater than the V_{DET+}. The voltage detector has built−in hysteresis to prevent erratic reset operation as the comparator threshold is crossed.

Although these device series are specifically designed for use as reset controllers in portable microprocessor based systems, they offer a cost−effective solution in numerous applications where precise voltage monitoring is required. Figure 26 through Figure 33 shows various application examples.

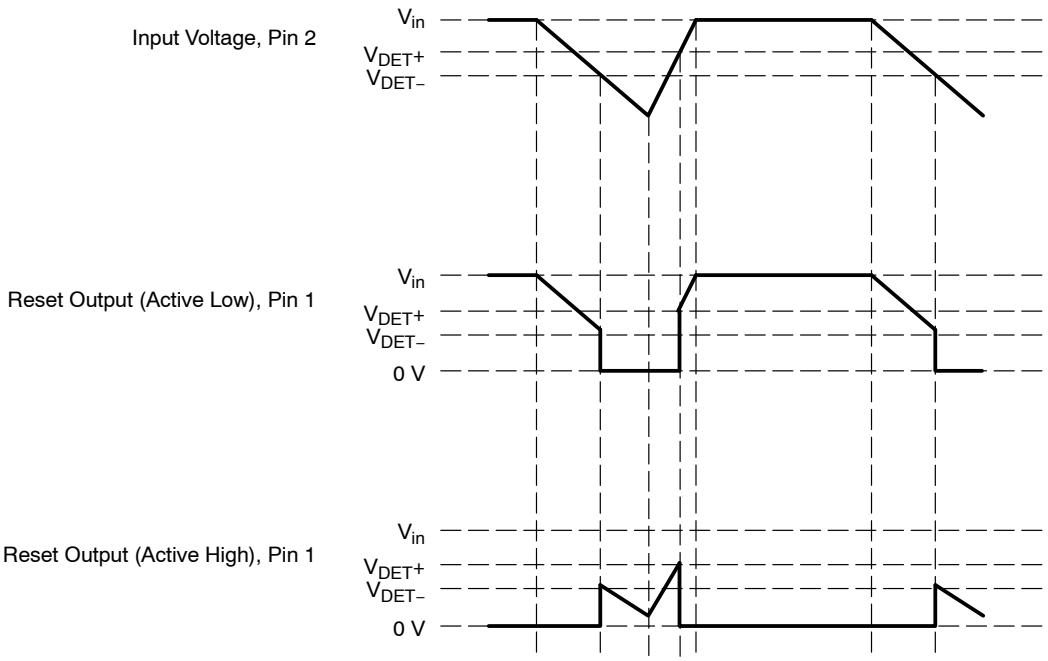


Figure 21. Timing Waveforms

V_{CC} TRANSIENT REJECTION

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

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

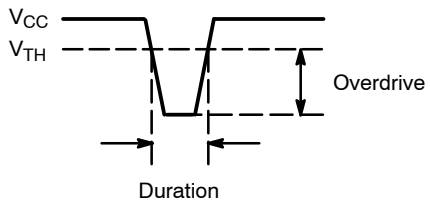


Figure 22. Max Transient Duration vs. Max Overdrive

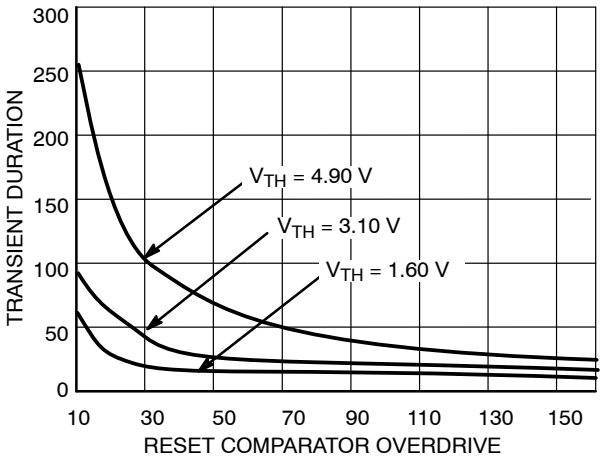


Figure 23.

FACTORS TO BE CONSIDERED FOR VOLTAGE OPTION SELECTION

The following hysteresis graph depicts $V_{DET-_min/max}$ and $V_{DET+_min/max}$ for an active low Reset device:

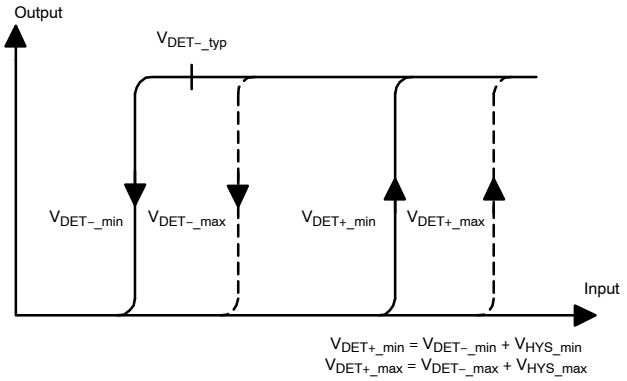


Figure 24.

For selecting a voltage option in the NCP30X family, three major factors should be considered:

1. V_{DET+_max}: Maximum detector threshold voltage for increasing V_{in} for the NCP30X device.
2. V_{in_min}: Minimum voltage output of the power supply. This is also the input voltage to the NCP30X device.
3. V_{CC_min}: Minimum power supply voltage specification for the device that is protected by the NCP30X.

The V_{DET+_max} for an NCP30X device is normally calculated as follows:

$$V_{DET+_max} = V_{DET-_max} + V_{HYS_max} \quad \text{(eq. 1)}$$

Where:

V_{DET-_max} = Maximum detector threshold voltage for decreasing Vin

V_{HYS_max} = Maximum detector threshold hysteresis

The above two parameters can be obtained directly from the data sheet to figure out the V_{DET+_max}.

In the NCP30X family, for a given V_{DET-_typ}, which is the typical detection voltage reflected in the part number, the threshold values are designed to the following targets (at 25°C):

$$V_{DET-_min} = V_{DET-_typ} - 2\% \quad \text{(eq. 2)}$$

$$V_{DET-_max} = V_{DET-_typ} + 2\% \quad \text{(eq. 3)}$$

$$V_{HYS_typ} = 5\% \text{ of } V_{DET-_typ} \quad \text{(eq. 4)}$$

$$V_{HYS_min} = V_{HYS_typ} - 40\% \quad \text{(eq. 5)}$$

$$V_{HYS_max} = V_{HYS_typ} + 40\% \quad \text{(eq. 6)}$$

By simple mathematical calculation, combining Equations 2 to 6, Equation 1 becomes:

$$V_{DET+_max} = V_{DET-_typ} \times 1.09 \quad \text{(eq. 7)}$$

So, V_{DET+_max} can be easily figured out just using a single variable V_{DET-_typ}.

For example, for NCP300LSN18T1G V_{DET-_typ} = 1.8 V; then

$$V_{DET+_max} = 1.8 \times 1.09 = 1.962\ V \quad \text{(eq. 8)}$$

The NCP30X detection voltage option must be chosen such that:

$$V_{CC_min} < V_{DET+_max} < V_{in_min} \quad \text{(eq. 9)}$$

The significance of $V_{CC_min} < V_{DET+_max}$ is that it makes sure the the reset from NCP30X remains asserted (in RESET hold state) till after the power supply exceeds the V_{CC_min} requirement; this prevents incorrect device (uP) initiation.

Having $V_{DET+_max} < V_{in_min}$ makes sure that the NCP30X is able to start up when V_{in} is at the V_{in_min}.

The theoretical ideal V_{DET-_typ} voltage option to be selected by the user, $V_{DET-_typ_ideal}$, can be given by the following formula:

$$V_{DET-_typ_ideal} = \frac{\left(V_{in_min} + V_{CC_min}\right)}{(2 \times 1.09)} \quad \text{(eq. 10)}$$

The following example shows how to select the device voltage option in a real world application.

1. Power supply output specification: 3.3 V ±3%
2. Microprocessor core voltage specification: 3.3 V ±5%

So, we have:

$$V_{in_min} = 3.3\ V - 3\% = 3.201\ V \quad \text{(eq. 11)}$$

$$V_{CC_min} = 3.3\ V - 5\% = 3.135\ V \quad \text{(eq. 12)}$$

Then the ideal voltage option = (3.201 + 3.135) / (2 * 1.09) = 2.9064 V

Therefore, a device voltage option of 2.9 V will be the right choice.

PROPAGATION DELAY VARIATION

On the other hand (see above paragraph), a minimum overdrive value from $V_{threshold}$ to V_{CC} must be respected. That means V_{in} (minimum value of V_{CC}) must be higher enough than V_{DET+} (V_{DET-} + hysteresis) at the risk of significantly increasing propagation delay. (Figure 25) This propagation delay is temperature sensitive.

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

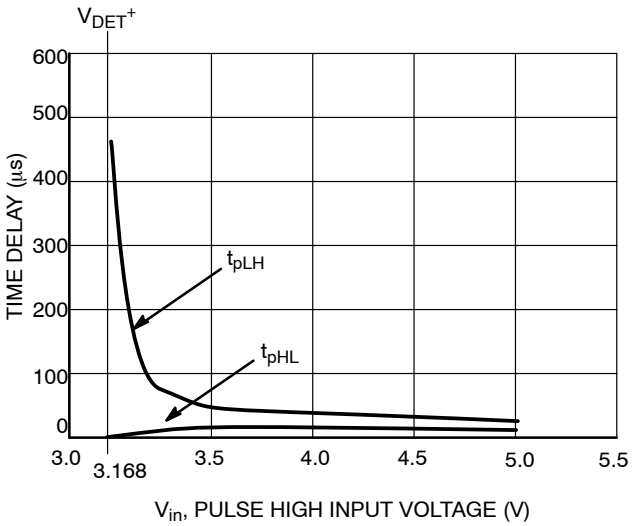


Figure 25. t_{pLH} and t_{pHL} vs. Input Voltage for the NCP301SNT1

APPLICATION CIRCUIT INFORMATION

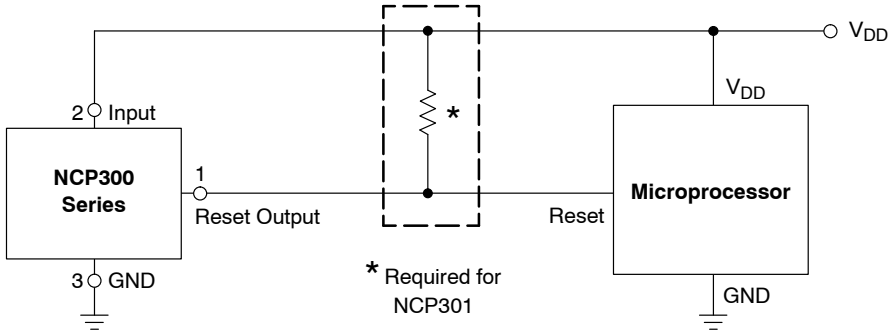


Figure 26. Microprocessor Reset Circuit

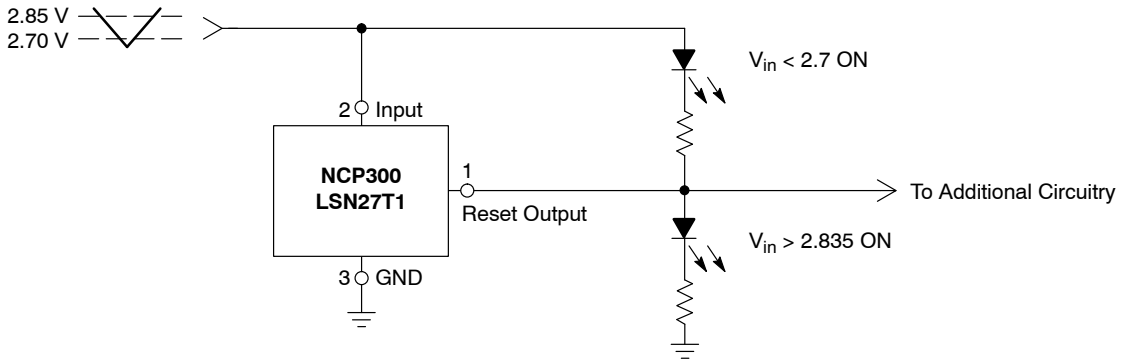
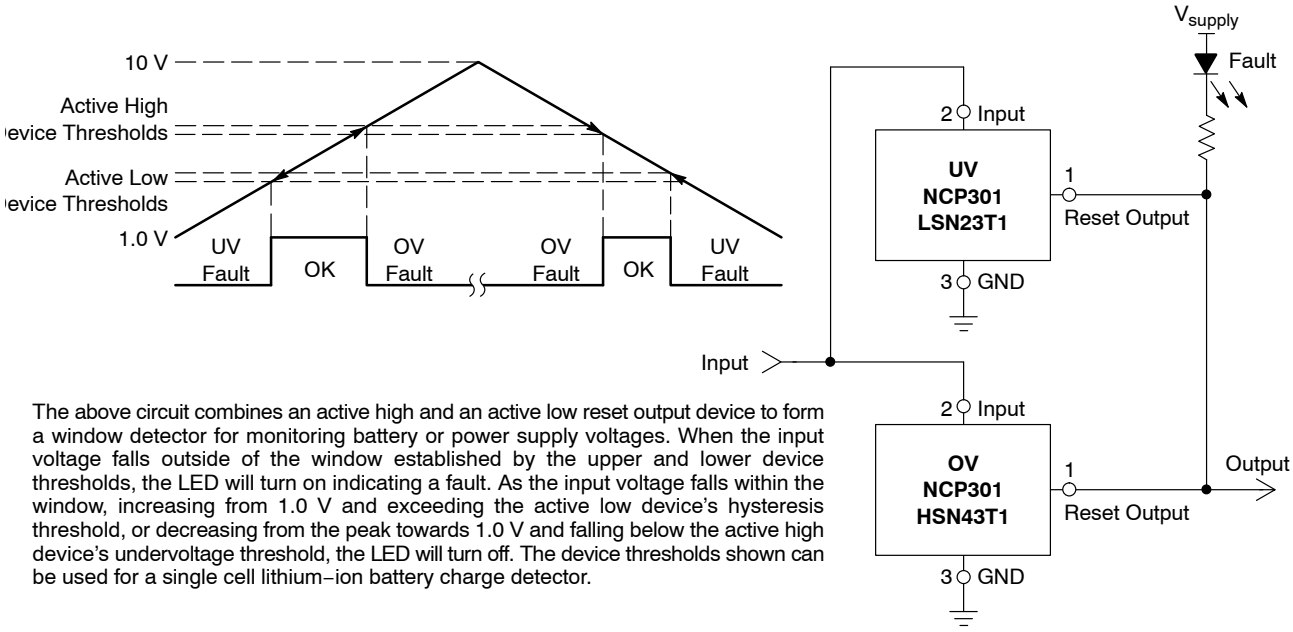


Figure 27. Battery Charge Indicator



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

Figure 28. Window Voltage Detector

APPLICATION CIRCUIT INFORMATION

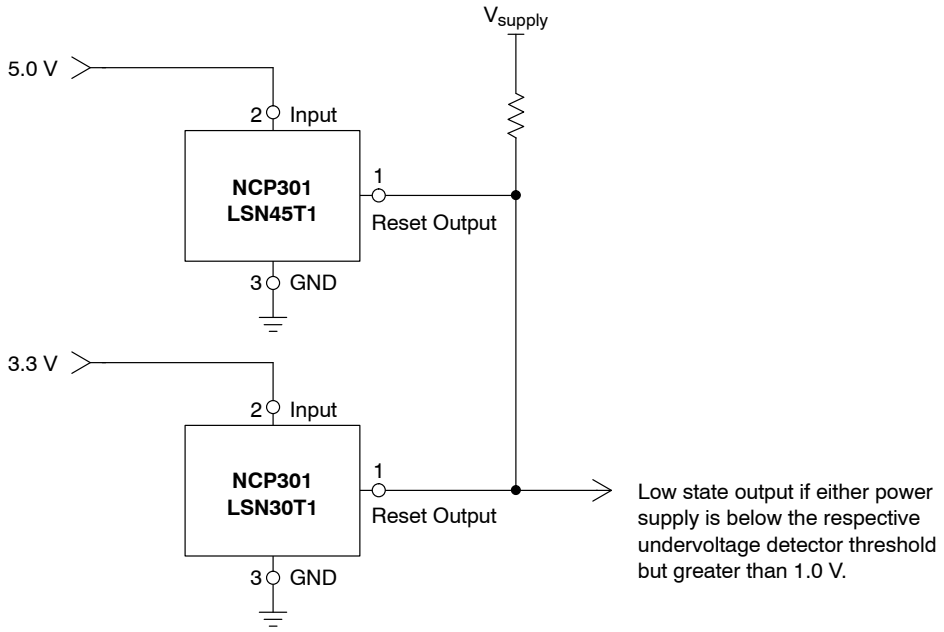


Figure 29. Dual Power Supply Undervoltage Supervision

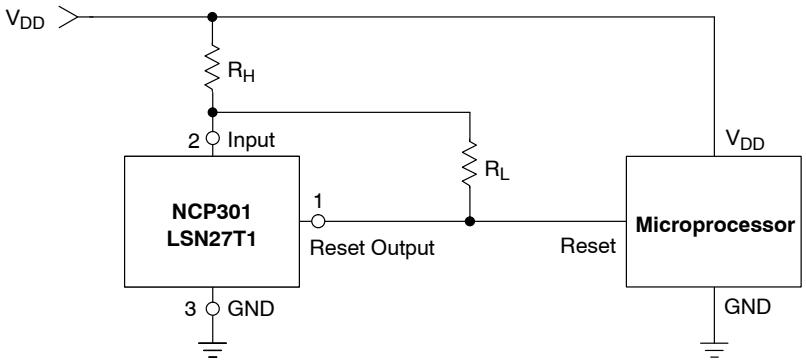


Figure 30. Microprocessor Reset Circuit with Additional Hysteresis

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 μA at 2.6 V.

V_{in} Decreasing:

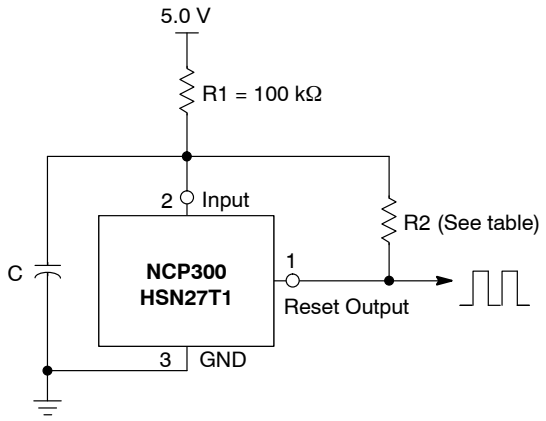
$$V_{th} = \left(\frac{R_H}{R_{in}} + 1\right)(V_{DET-})$$

V_{in} Increasing:

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

$V_{HYS} = V_{in}$ Increasing − V_{in} Decreasing

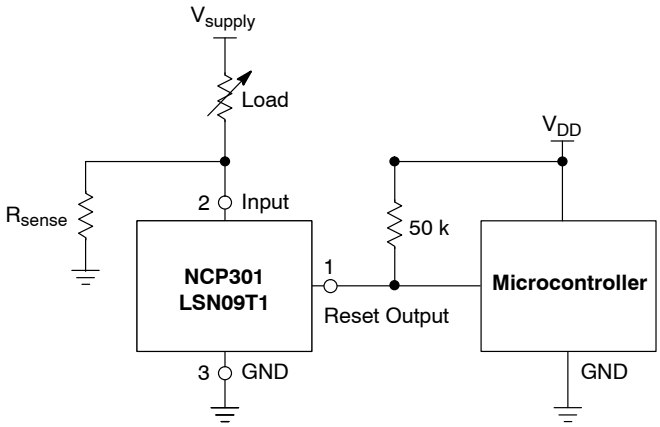
Test Data				
V_{th} Decreasing (V)	V_{th} Increasing (V)	V_{HYS} (V)	R_H (Ω)	R_L (kΩ)
2.70	2.84	0.135	0	–
2.70	2.87	0.17	100	10
2.70	2.88	0.18	100	6.8
2.70	2.91	0.21	100	4.3
2.70	2.90	0.20	220	10
2.70	2.94	0.24	220	6.8
2.70	2.98	0.28	220	4.3
2.70	2.97	0.27	470	10
2.70	3.04	0.34	470	6.8
2.70	3.15	0.45	470	4.3



Test Data				
	R2 = 82 kΩ		R2 = 8.2 kΩ	
C (nF)	f_{OSC} (kHz)	I_Q (μA)	f_{OSC} (kHz)	I_Q (μA)
0.01	10.4	18	6.0	30
0.068	9.8	18	5.7	30
1.0	6.18	21	3.6	29
10	1.41	21	1.34	25
100	0.27	22	0.356	23
1000	0.045	22	0.077	22

Table values are for information only.

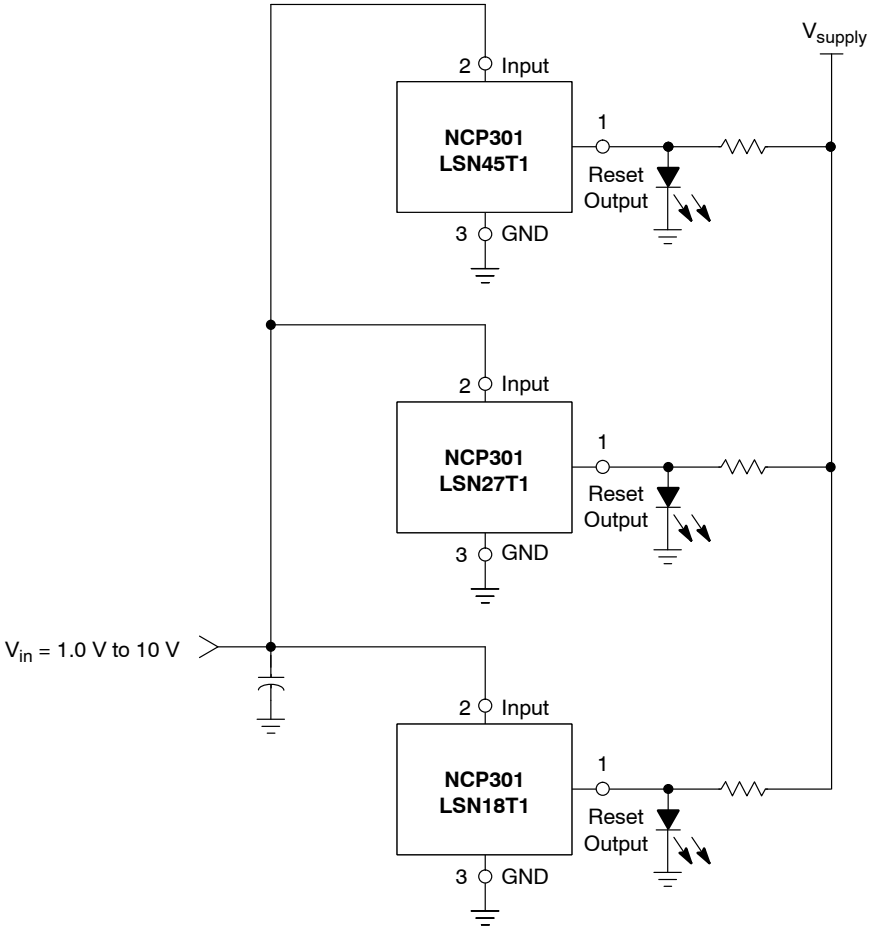
Figure 31. Simple Clock Oscillator



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 32. Microcontroller System 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 33. LED Bar Graph Voltage Monitor

ORDERING INFORMATION (Note 25)

Device	Threshold Voltage	Output Type	Reset	Marking	Package	Shipping†
NCV300LSN28T1G*	2.8	CMOS	Active Low	SSL	TSOP−5 (Pb−Free)	3000 / Tape & Reel (7 in. Reel)
NCV300LSN36T1G*	3.6			SKS	TSOP−5 (Pb−Free)	
DISCONTINUED						
NCP300LSN09T1G	0.9	CMOS	Active Low	SEJ	TSOP−5 (Pb−Free)	3000 / Tape & Reel (7 in. Reel)
NCP300LSN18T1G	1.8			SFK	TSOP−5 (Pb−Free)	
NCP300LSN185T1G	1.85			SRA	TSOP−5 (Pb−Free)	
NCP300LSN20T1G	2.0			SHE	TSOP−5 (Pb−Free)	
NCV300LSN20T1G*				SIM		
NCP300LSN25T1G	2.5			RUM	TSOP−5 (Pb−Free)	
NCP300LSN27T1G	2.7			SEE	TSOP−5 (Pb−Free)	
NCV300LSN27T1G*				SIW		
NCP300LSN28T1G	2.8			SED	TSOP−5 (Pb−Free)	
NCP300LSN30T1G	3.0			SEC	TSOP−5 (Pb−Free)	
NCV300LSN30T1G*				SQV		
NCP300LSN33T1G	3.3			SKV	TSOP−5 (Pb−Free)	
NCP300LSN34T1G	3.4			SKU	TSOP−5 (Pb−Free)	
NCP300LSN44T1G	4.4			SKK	TSOP−5 (Pb−Free)	
NCP300LSN45T1G	4.5			SEA	TSOP−5 (Pb−Free)	
NCP300LSN46T1G	4.6			SKJ	TSOP−5 (Pb−Free)	
NCP300LSN47T1G	4.7			SDZ	TSOP−5 (Pb−Free)	
NCP300HSN09T1G	0.9	CMOS	Active High	SDY	TSOP−5 (Pb−Free)	3000 / Tape & Reel (7 in. Reel)
NCP300HSN18T1G	1.8			SFJ	TSOP−5 (Pb−Free)	
NCP300HSN27T1G	2.7			SDU	TSOP−5 (Pb−Free)	
NCP300HSN30T1G	3.0			SDS	TSOP−5 (Pb−Free)	
NCP300HSN45T1G	4.5			SDQ	TSOP−5 (Pb−Free)	
NCP300HSN47T1G	4.7			SDP	TSOP−5 (Pb−Free)	

NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and NCP300/NCP301 active high output devices, ranging from 0.9 V to 4.9 V in 100 mV increments can be manufactured. Contact your **onsemi** representative for availability. The electrical characteristics of these additional devices are shown in Tables 1 through 4.

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

*NCV prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable.
NCVxxx: T_{low} = −40°C, T_{high} = +125°C. Guaranteed by design.

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

ORDERING INFORMATION (Note 26)

Device	Threshold Voltage	Output Type	Reset	Marking	Package	Shipping†
NCV301LSN22T1G*	2.2	Open Drain	Active Low	SUA	TSOP−5 (Pb−Free)	3000 / Tape & Reel (7 in. Reel)
NCV301LSN28T1G*	2.8			SRO	TSOP−5 (Pb−Free)	3000 / Tape & Reel (7 in. Reel)
DISCONTINUED						
NCP301LSN09T1G	0.9	Open Drain	Active Low	SFF	TSOP−5 (Pb−Free)	3000 / Tape & Reel (7 in. Reel)
NCP301LSN12T1G	1.2			SNN	TSOP−5 (Pb−Free)	
NCV301LSN12T1*				SRK	TSOP−5	
NCV301LSN12T1G*					TSOP−5 (Pb−Free)	
NCP301LSN16T1G	1.6			SNJ	TSOP−5 (Pb−Free)	
NCV301LSN16T1*				SRL	TSOP−5	
NCV301LSN16T1G*					TSOP−5 (Pb−Free)	
NCP301LSN18T1G	1.8			SFN	TSOP−5 (Pb−Free)	
NCP301LSN18T2G				DT2	TSOP−5 (Pb−Free)	
NCP301LSN20T1G	2.0			SFD	TSOP−5 (Pb−Free)	
NCV301LSN20T1G*				SRM		
NCP301LSN22T1G	2.2			SNG	TSOP−5 (Pb−Free)	
NCV301LSN22T1*				SUA	TSOP−5	
NCP301LSN24T1G	2.4			TAN	TSOP−5 (Pb−Free)	
NCP301LSN25T1G	2.5			SNF	TSOP−5 (Pb−Free)	
NCP301LSN25T2G				ET2	TSOP−5 (Pb−Free)	
NCV301LSN25T1G*				SRN	TSOP−5 (Pb−Free)	
NCP301LSN26T1G	2.6			SNE	TSOP−5 (Pb−Free)	
NCP301LSN27T1G	2.7			SFA	TSOP−5 (Pb−Free)	
NCP301LSN27T2G				FT2	TSOP−5 (Pb−Free)	
NCP301LSN28T1G	2.8			SEZ	TSOP−5 (Pb−Free)	
NCP301LSN30T1G	3.0			SEY	TSOP−5 (Pb−Free)	
NCP301LSN30T2G				GT2	TSOP−5 (Pb−Free)	
NCV301LSN30T1G*				AJA	TSOP−5 (Pb−Free)	
NCP301LSN31T1G	3.1			SEW	TSOP−5 (Pb−Free)	
NCP301LSN32T1G	3.2			SNC	TSOP−5 (Pb−Free)	

NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and NCP300/NCP301 active high output devices, ranging from 0.9 V to 4.9 V in 100 mV increments can be manufactured. Contact your **onsemi** representative for availability. The electrical characteristics of these additional devices are shown in Tables 1 through 4.

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

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

ORDERING INFORMATION (Note 27)

Device	Threshold Voltage	Output Type	Reset	Marking	Package	Shipping†
NCV301LSN33T1G*	3.3	Open Drain	Active Low	ACG	TSOP−5 (Pb−Free)	3000 / Tape & Reel (7 in. Reel)
NCV301LSN40T1G*	4.0			SRP	TSOP−5 (Pb−Free)	
NCV301LSN42T1G*	4.2			ACR	TSOP−5 (Pb−Free)	
DISCONTINUED						
NCP301LSN33T1G	3.3	Open Drain	Active Low	SNB	TSOP−5 (Pb−Free)	3000 / Tape & Reel (7 in. Reel)
NCP301LSN34T1G	3.4			SNA	TSOP−5 (Pb−Free)	
NCP301LSN36T1G	3.6			SMY		
NCP301LSN39T1G	3.9			SNA		
NCP301LSN40T1G	4.0			SMU	TSOP−5 (Pb−Free)	
NCV301LSN40T1*				SRP	TSOP−5	
NCP301LSN42T1G	4.2			SMS	TSOP−5 (Pb−Free)	
NCP301LSN45T1G	4.5			SEV	TSOP−5 (Pb−Free)	
NCV301LSN45T1G*				SRQ		
NCP301LSN46T1G	4.6			SMP	TSOP−5 (Pb−Free)	
NCP301LSN47T1G	4.7			SEU	TSOP−5 (Pb−Free)	
NCV301LSN47T1G*				SSJ		

NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and NCP300/NCP301 active high output devices, ranging from 0.9 V to 4.9 V in 100 mV increments can be manufactured. Contact your **onsemi** representative for availability. The electrical characteristics of these additional devices are shown in Tables 1 through 4.

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

ORDERING INFORMATION (Note 28)

Device	Threshold Voltage	Output Type	Reset	Marking	Package	Shipping†
DISCONTINUED						
NCP301HSN09T1G	0.9	Open Drain	Active High	SET	TSOP−5 (Pb−Free)	3000 / Tape & Reel (7 in. Reel)
NCP301HSN18T1G	1.8			SFM	TSOP−5 (Pb−Free)	
NCP301HSN22T1G	2.2			SMD	TSOP−5 (Pb−Free)	
NCP301HSN27T1G	2.7			SEP	TSOP−5 (Pb−Free)	
NCV301HSN27T1G*				SUD		
NCP301HSN30T1G	3.0			SEN	TSOP−5 (Pb−Free)	
NCP301HSN45T1G	4.5			SEL	TSOP−5 (Pb−Free)	

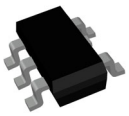
NOTE: The ordering information lists standard undervoltage thresholds with active low outputs. Additional active low threshold devices, ranging from 0.9 V to 4.9 V in 100 mV increments and NCP300/NCP301 active high output devices, ranging from 0.9 V to 4.9 V in 100 mV increments can be manufactured. Contact your **onsemi** representative for availability. The electrical characteristics of these additional devices are shown in Tables 1 through 4.

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

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

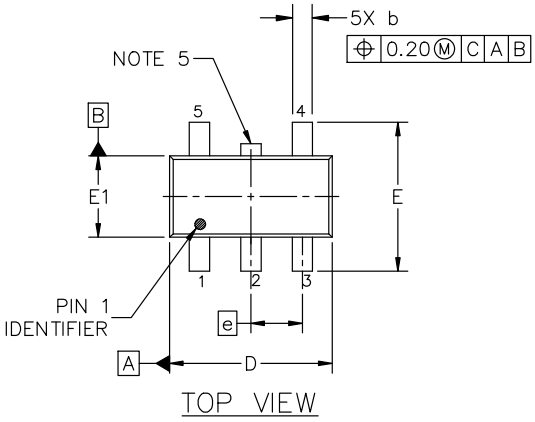
28. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on www.onsemi.com.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

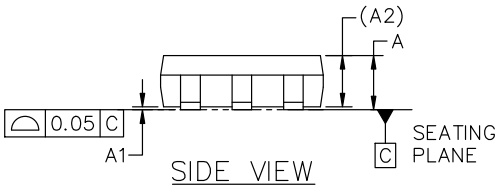


TSOP−5 3.00x1.50x0.95, 0.95P
CASE 483
ISSUE P

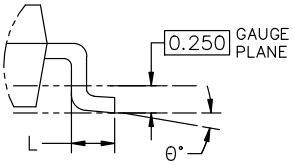
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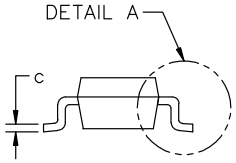
TOP VIEW



SIDE VIEW



DETAIL "A"
SCALE 2:1

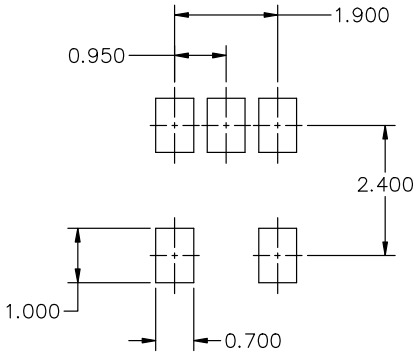


END VIEW

NOTES:

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

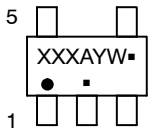
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.900	1.000	1.100
A1	0.010	0.055	0.100
A2		0.950 REF.	
b	0.250	0.375	0.500
c	0.100	0.180	0.260
D	2.850	3.000	3.150
E	2.500	2.750	3.000
E1	1.350	1.500	1.650
e		0.950 BSC	
L	0.200	0.400	0.600
θ	0°	5°	10°



RECOMMENDED MOUNTING 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.

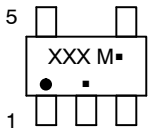
GENERIC
MARKING DIAGRAM*



Analog

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

(Note: Microdot may be in either location)



Discrete/Logic

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

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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