NCP300, NCP301

Voltage Detector Series

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

Each series features a highly accurate under voltage 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 TSOP–5 package with seven standard under voltage 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 Under Voltage 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

Typical Applications

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

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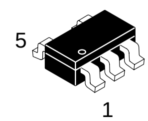
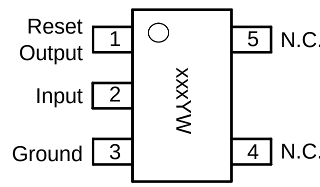


TSOP–5
SN SUFFIX
CASE 483

PIN CONNECTIONS AND MARKING DIAGRAM



xxx = 300 or 301
Y = Year
W = Work Week

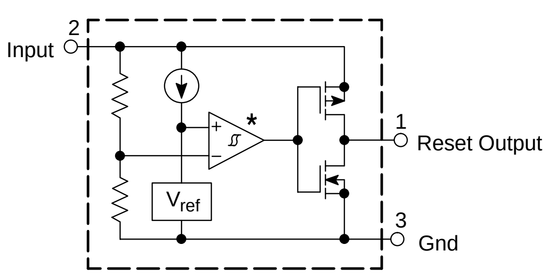
(Top View)

ORDERING INFORMATION

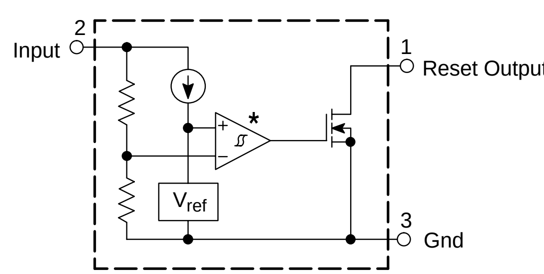
See detailed ordering and shipping information in the ordering information section on page 18 of this data sheet.

Representative Block Diagrams

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.

November, 2000 – Rev. 3

Publication Order Number:
NCP300/D

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
Operating Junction Temperature Range	T_J	–40 to +125	°C
Storage Temperature Range	T_{stg}	–55 to +150	°C

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.

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

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
NCP300/1 – 0.9					
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) Nch Sink Current, NCP300, NCP301 (V_{OUT} = 0.05V, V_{in} = 0.70V) (V_{OUT} = 0.50V, V_{in} = 0.85V) Pch Source Current, NCP300 (V_{OUT} = 2.4V, V_{in} = 4.5V)	I_{OUT}	 0.01 0.05 1.0	 0.05 0.50 2.0	 – – –	mA
Propagation Delay Input to Output (Figure 1) 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	 t_{pHL} t_{pLH} t_{pHL}	 – – –	 97 77 97	 – – –	µs

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
NCP300/1 – 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 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 = –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) Nch Sink Current, NCP300, NCP301 (V_{OUT} = 0.05V, V_{in} = 0.70V) (V_{OUT} = 0.50V, V_{in} = 1.5V) Pch Source Current, NCP300 (V_{OUT} = 2.4V, V_{in} = 4.5V)	I_{OUT}	 0.01 1.0 1.0	 0.05 2.0 2.0	 – – –	mA
Propagation Delay Input to Output (Figure 1) 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	 t_{pHL} t_{pLH} t_{pHL}	 – – –	 73 94 73	 – – –	µs

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
NCP300/1 – 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 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 = –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) Nch Sink Current, NCP300, NCP301 (V_{OUT} = 0.05V, V_{in} = 0.70V) (V_{OUT} = 0.50V, V_{in} = 1.5V) Pch Source Current, NCP300 (V_{OUT} = 2.4V, V_{in} = 4.5V)	I_{OUT}	 0.01 1.0 1.0	 0.05 2.0 2.0	 – – –	mA
Propagation Delay Input to Output (Figure 1) 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	 t_{pHL} t_{pLH} t_{pHL}	 – – –	 55 108 55	 – – –	µs

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
NCP300/1– 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 V) (V_{in} = 4.7 V)	I_{in}	 – –	 0.26 0.46	 0.8 1.3	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) Nch Sink Current, NCP300, NCP301 (V_{OUT} = 0.05V, V_{in} = 0.70V) (V_{OUT} = 0.50V, V_{in} = 1.5V) Pch Source Current, NCP300 (V_{OUT} = 2.4V, V_{in} = 4.5V)	I_{OUT}	 0.01 1.0 1.0	 0.05 2.0 2.0	 – – –	mA
Propagation Delay Input to Output (Figure 1) 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	 t_{pHL} t_{pLH} t_{pHL}	 – – –	 55 115 55	 – – –	µs

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

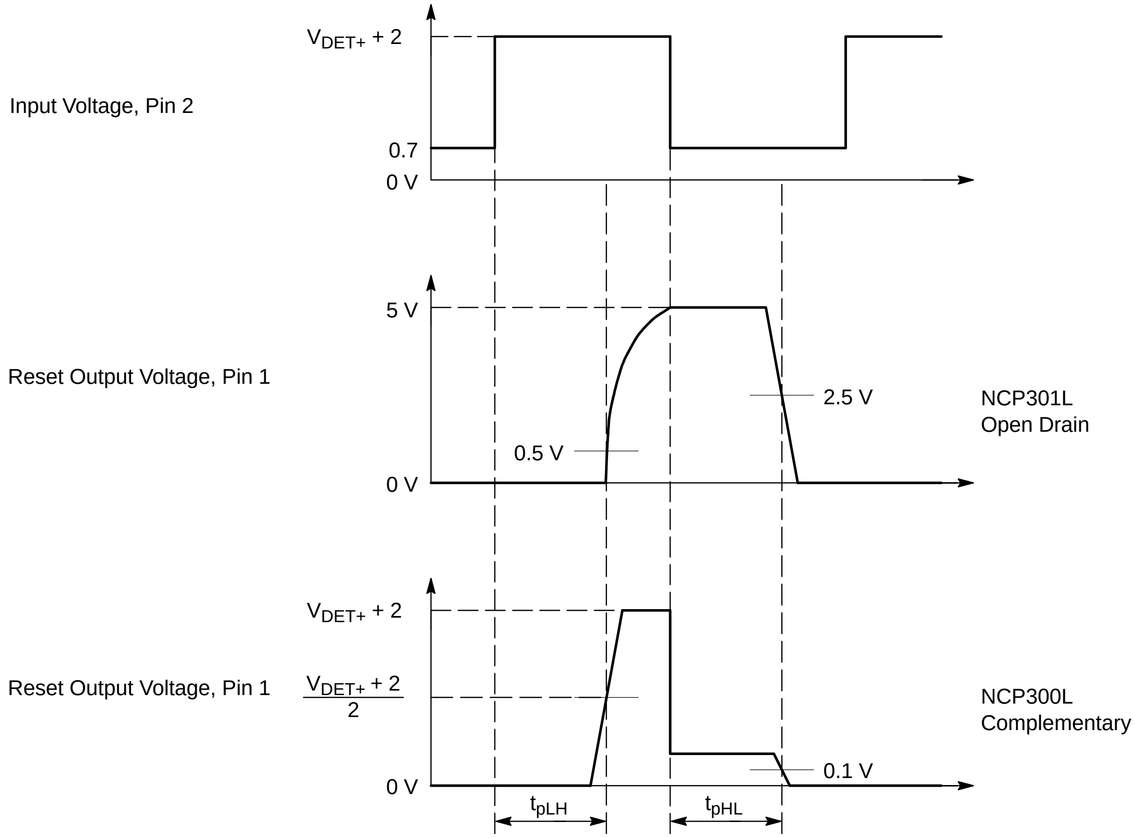
Characteristic	Symbol	Min	Typ	Max	Unit
NCP300/1 – 3.0					
Detector Threshold (Pin 2, V_{in} Decreasing)	V_{DET-}	2.94	3.00	3.06	V
Detector Threshold Hysteresis (Pin 2, V_{in} Increasing)	V_{HYS}	0.09	0.15	0.21	V
Supply Current (Pin 2) (V_{in} = 2.87 V) (V_{in} = 5.0 V)	I_{in}	 – –	 0.27 0.47	 0.9 1.3	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) Nch Sink Current, NCP300, NCP301 (V_{OUT} = 0.05V, V_{in} = 0.70V) (V_{OUT} = 0.50V, V_{in} = 1.5V) Pch Source Current, NCP300 (V_{OUT} = 2.4V, V_{in} = 4.5V)	I_{OUT}	 0.01 1.0 1.0	 0.05 2.0 2.0	 – – –	mA
Propagation Delay Input to Output (Figure 1) 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	 t_{pHL} t_{pLH} t_{pHL}	 – – –	 49 115 49	 – – –	µs

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
NCP300/1 – 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 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
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) Nch Sink Current, NCP300, NCP301 (V_{OUT} = 0.05V, V_{in} = 0.70V) (V_{OUT} = 0.50V, V_{in} = 1.5V) Pch Source Current, NCP300 (V_{OUT} = 5.9V, V_{in} = 8.0V)	I_{OUT}	 0.01 1.0 1.5	 0.05 2.0 3.0	 – – –	mA
Propagation Delay Input to Output (Figure 1) 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	 t_{pHL} t_{pLH} t_{pHL}	 – – –	 49 130 49	 – – –	µs

ELECTRICAL CHARACTERISTICS (For all values T_A = 25°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
NCP300/1 – 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 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 = –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) Nch Sink Current, NCP300, NCP301 (V_{OUT} = 0.05V, V_{in} = 0.70V) (V_{OUT} = 0.50V, V_{in} = 1.5V) Pch Source Current, NCP300 (V_{OUT} = 5.9V, V_{in} = 8.0V)	I_{OUT}	 0.01 1.0 1.5	 0.05 2.0 3.0	 – – –	mA
Propagation Delay Input to Output (Figure 1) 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	 t_{pHL} t_{pLH} t_{pHL}	 – – –	 45 130 45	 – – –	µs



NCP300 and NCP301 series are measured with a 10 pF capacitive load. NCP301 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. The upper detector threshold, V_{DET+} is the sum of the lower detector threshold, V_{DET-} plus the input hysteresis, V_{HYS}.

Figure 1. 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)			V_{HYS} (V)			I_{in} (μA) (1)	I_{in} (μA) (2)	I_{OUT} (mA) (3)	I_{OUT} (mA) (4)	I_{OUT} (mA) (5)
Part Number	Min	Typ	Max	Min	Typ	Max	Typ	Typ	Typ	Typ	Typ
NCP300(L/H)SN09T1	0.882	0.9	0.918	0.027	0.045	0.063	0.3	0.5	0.05	0.5	2.0
NCP300(L/H)SN10T1	0.980	1.0	1.020	0.030	0.050	0.070					
NCP300(L/H)SN11T1	1.078	1.1	1.122	0.033	0.055	0.077				1.0	
NCP300(L/H)SN12T1	1.176	1.2	1.224	0.036	0.060	0.084					
NCP300(L/H)SN13T1	1.274	1.3	1.326	0.039	0.065	0.091					
NCP300(L/H)SN14T1	1.372	1.4	1.428	0.042	0.070	0.098					
NCP300(L/H)SN15T1	1.470	1.5	1.530	0.045	0.075	0.105					
NCP300(L/H)SN16T1	1.568	1.6	1.632	0.048	0.080	0.112				2.0	
NCP300(L/H)SN17T1	1.666	1.7	1.734	0.051	0.085	0.119					
NCP300(L/H)SN18T1	1.764	1.8	1.836	0.054	0.090	0.126					
NCP300(L/H)SN19T1	1.862	1.9	1.938	0.057	0.095	0.133					
NCP300(L/H)SN20T1	1.960	2.0	2.040	0.060	0.100	0.140					
NCP300(L/H)SN21T1	2.058	2.1	2.142	0.063	0.105	0.147					
NCP300(L/H)SN22T1	2.156	2.2	2.244	0.066	0.110	0.154					
NCP300(L/H)SN23T1	2.254	2.3	2.346	0.069	0.115	0.161					
NCP300(L/H)SN24T1	2.352	2.4	2.448	0.072	0.120	0.168					
NCP300(L/H)SN25T1	2.450	2.5	2.550	0.075	0.125	0.175					
NCP300(L/H)SN26T1	2.548	2.6	2.652	0.078	0.130	0.182					
NCP300(L/H)SN27T1	2.646	2.7	2.754	0.081	0.135	0.189					
NCP300(L/H)SN28T1	2.744	2.8	2.856	0.084	0.140	0.196					
NCP300(L/H)SN29T1	2.842	2.9	2.958	0.087	0.145	0.203					
NCP300(L/H)SN30T1	2.940	3.0	3.060	0.090	0.150	0.210					
NCP300(L/H)SN31T1	3.038	3.1	3.162	0.093	0.155	0.217					
NCP300(L/H)SN32T1	3.136	3.2	3.264	0.096	0.160	0.224					
NCP300(L/H)SN33T1	3.234	3.3	3.366	0.099	0.165	0.231					
NCP300(L/H)SN34T1	3.332	3.4	3.468	0.102	0.170	0.238					
NCP300(L/H)SN35T1	3.430	3.5	3.570	0.105	0.175	0.245					
NCP300(L/H)SN36T1	3.528	3.6	3.672	0.108	0.180	0.252					
NCP300(L/H)SN37T1	3.626	3.7	3.774	0.111	0.185	0.259					
NCP300(L/H)SN38T1	3.724	3.8	3.876	0.114	0.190	0.266					
NCP300(L/H)SN39T1	3.822	3.9	3.978	0.117	0.195	0.273					
NCP300(L/H)SN40T1	3.920	4.0	4.080	0.120	0.200	0.280	0.4	0.6			3.0
NCP300(L/H)SN41T1	4.018	4.1	4.182	0.123	0.205	0.287					
NCP300(L/H)SN42T1	4.116	4.2	4.284	0.126	0.210	0.294					
NCP300(L/H)SN43T1	4.214	4.3	4.386	0.129	0.215	0.301					
NCP300(L/H)SN44T1	4.312	4.4	4.488	0.132	0.220	0.308					
NCP300(L/H)SN45T1	4.410	4.5	4.590	0.135	0.225	0.315					
NCP300(L/H)SN46T1	4.508	4.6	4.692	0.138	0.230	0.322					
NCP300(L/H)SN47T1	4.606	4.7	4.794	0.141	0.235	0.329					
NCP300(L/H)SN48T1	4.704	4.8	4.896	0.144	0.240	0.336					
NCP300(L/H)SN49T1	4.802	4.9	4.998	0.147	0.245	0.343					

(1) 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
(2) Condition 2: 0.9 — 4.9 V, $V_{in} = V_{DET-} + 2.0$ V
(3) Condition 3: 0.9 — 4.9 V, $V_{in} = 0.7$ V, $V_{OUT} = 0.05$ V, Active Low ‘L’ Suffix Devices
(4) 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
(5) 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

Table 2. 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)			V_{HYS} (V)			I_{in} (μA) (1)	I_{in} (μA) (2)	I_{OUT} (mA) (3)	I_{OUT} (mA) (4)
Part Number	Min	Typ	Max	Min	Typ	Max	Typ	Typ	Typ	Typ
NCP301(L/H)SN09T1	0.882	0.9	0.918	0.027	0.045	0.063	0.3	0.5	0.05	0.5
NCP301(L/H)SN10T1	0.980	1.0	1.020	0.030	0.050	0.070				
NCP301(L/H)SN11T1	1.078	1.1	1.122	0.033	0.055	0.077				1.0
NCP301(L/H)SN12T1	1.176	1.2	1.224	0.036	0.060	0.084				
NCP301(L/H)SN13T1	1.274	1.3	1.326	0.039	0.065	0.091				
NCP301(L/H)SN14T1	1.372	1.4	1.428	0.042	0.070	0.098				
NCP301(L/H)SN15T1	1.470	1.5	1.530	0.045	0.075	0.105				
NCP301(L/H)SN16T1	1.568	1.6	1.632	0.048	0.080	0.112				2.0
NCP301(L/H)SN17T1	1.666	1.7	1.734	0.051	0.085	0.119				
NCP301(L/H)SN18T1	1.764	1.8	1.836	0.054	0.090	0.126				
NCP301(L/H)SN19T1	1.862	1.9	1.938	0.057	0.095	0.133				
NCP301(L/H)SN20T1	1.960	2.0	2.040	0.060	0.100	0.140				
NCP301(L/H)SN21T1	2.058	2.1	2.142	0.063	0.105	0.147				
NCP301(L/H)SN22T1	2.156	2.2	2.244	0.066	0.110	0.154				
NCP301(L/H)SN23T1	2.254	2.3	2.346	0.069	0.115	0.161				
NCP301(L/H)SN24T1	2.352	2.4	2.448	0.072	0.120	0.168				
NCP301(L/H)SN25T1	2.450	2.5	2.550	0.075	0.125	0.175				
NCP301(L/H)SN26T1	2.548	2.6	2.652	0.078	0.130	0.182				
NCP301(L/H)SN27T1	2.646	2.7	2.754	0.081	0.135	0.189				
NCP301(L/H)SN28T1	2.744	2.8	2.856	0.084	0.140	0.196				
NCP301(L/H)SN29T1	2.842	2.9	2.958	0.087	0.145	0.203				
NCP301(L/H)SN30T1	2.940	3.0	3.060	0.090	0.150	0.210				
NCP301(L/H)SN31T1	3.038	3.1	3.162	0.093	0.155	0.217				
NCP301(L/H)SN32T1	3.136	3.2	3.264	0.096	0.160	0.224				
NCP301(L/H)SN33T1	3.234	3.3	3.366	0.099	0.165	0.231				
NCP301(L/H)SN34T1	3.332	3.4	3.468	0.102	0.170	0.238				
NCP301(L/H)SN35T1	3.430	3.5	3.570	0.105	0.175	0.245				
NCP301(L/H)SN36T1	3.528	3.6	3.672	0.108	0.180	0.252				
NCP301(L/H)SN37T1	3.626	3.7	3.774	0.111	0.185	0.259				
NCP301(L/H)SN38T1	3.724	3.8	3.876	0.114	0.190	0.266				
NCP301(L/H)SN39T1	3.822	3.9	3.978	0.117	0.195	0.273				
NCP301(L/H)SN40T1	3.920	4.0	4.080	0.120	0.200	0.280	0.4	0.6		
NCP301(L/H)SN41T1	4.018	4.1	4.182	0.123	0.205	0.287				
NCP301(L/H)SN42T1	4.116	4.2	4.284	0.126	0.210	0.294				
NCP301(L/H)SN43T1	4.214	4.3	4.386	0.129	0.215	0.301				
NCP301(L/H)SN44T1	4.312	4.4	4.488	0.132	0.220	0.308				
NCP301(L/H)SN45T1	4.410	4.5	4.590	0.135	0.225	0.315				
NCP301(L/H)SN46T1	4.508	4.6	4.692	0.138	0.230	0.322				
NCP301(L/H)SN47T1	4.606	4.7	4.794	0.141	0.235	0.329				
NCP301(L/H)SN48T1	4.704	4.8	4.896	0.144	0.240	0.336				
NCP301(L/H)SN49T1	4.802	4.9	4.998	0.147	0.245	0.343				

(1) 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
(2) Condition 2: 0.9 — 4.9 V, $V_{in} = V_{DET-} + 2.0$ V
(3) Condition 3: 0.9 — 4.9 V, $V_{in} = 0.7$ V, $V_{OUT} = 0.05$ V, Active Low ‘L’ Suffix Devices
(4) 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

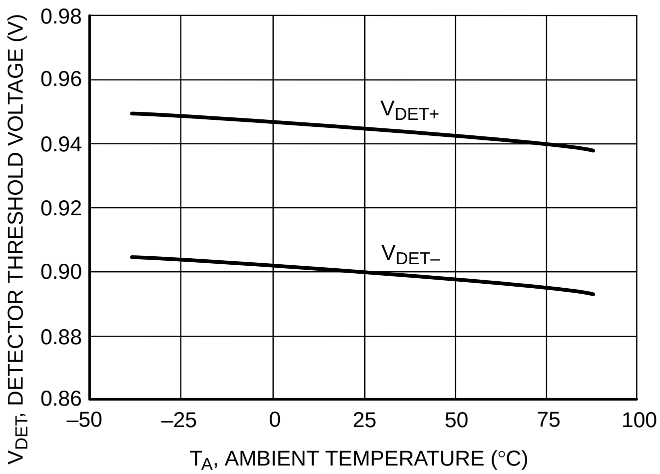


Figure 2. NCP300/1 Series 0.9 V Detector Threshold Voltage versus Temperature

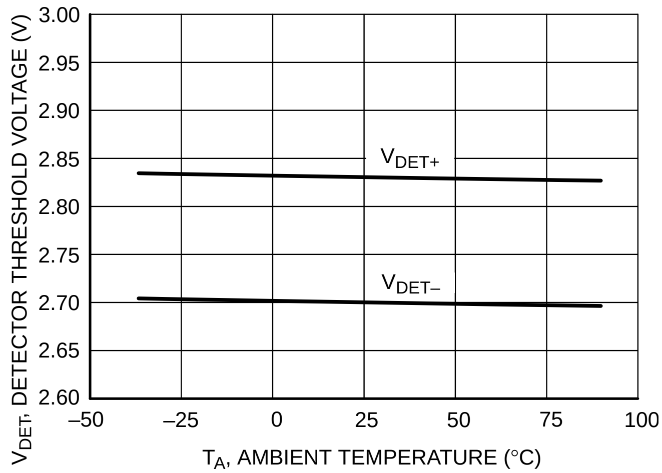


Figure 3. NCP300/1 Series 2.7 V Detector Threshold Voltage versus Temperature

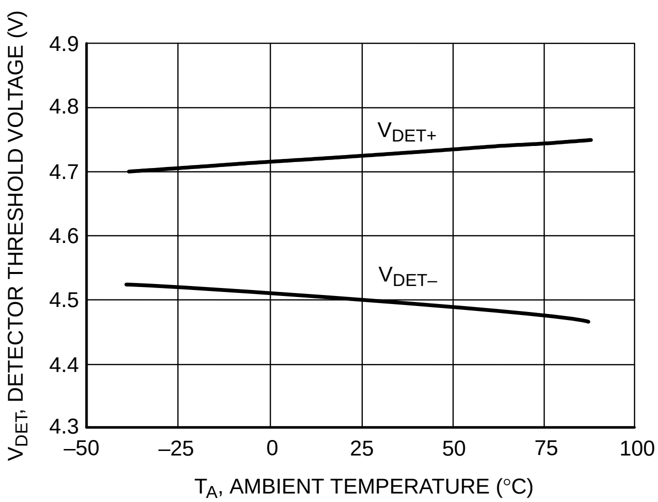


Figure 4. NCP300/1 Series 4.5 V Detector Threshold Voltage versus Temperature

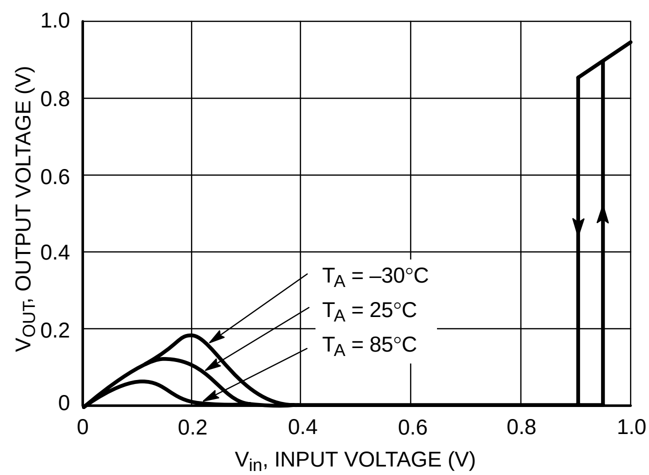


Figure 5. NCP300L/1L Series 0.9 V Reset Output Voltage versus Input Voltage

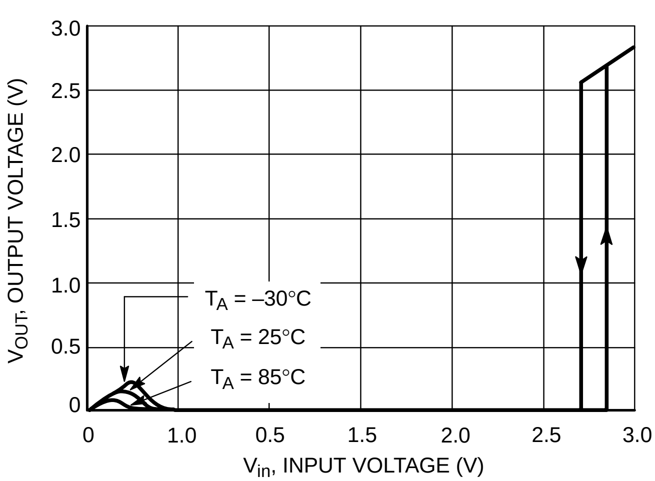


Figure 6. NCP300L/1L Series 2.7 V Reset Output Voltage versus Input Voltage

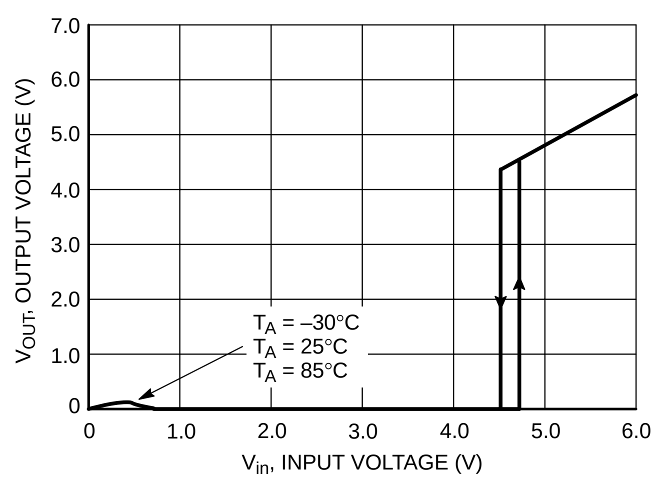


Figure 7. NCP300L/1L Series 4.5 V Reset Output Voltage versus Input Voltage

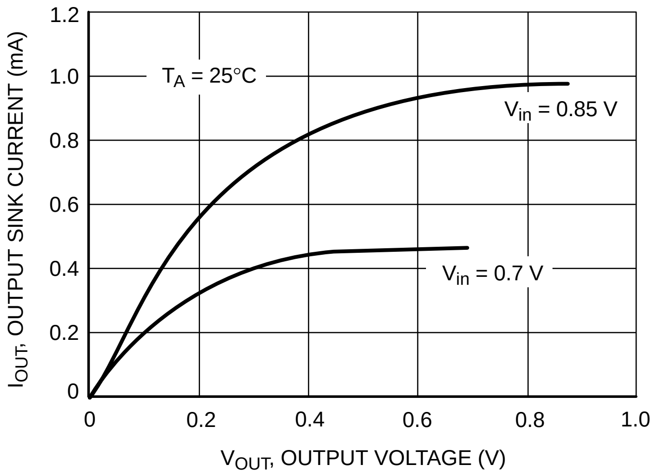


Figure 8. NCP300L/1L Series 0.9 V Reset Output Sink Current versus Output Voltage

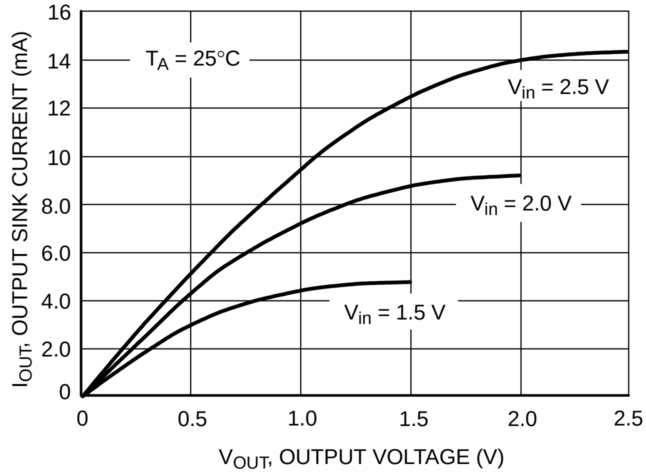


Figure 9. NCP300L/1L Series 2.7 V Reset Output Sink Current versus Output Voltage

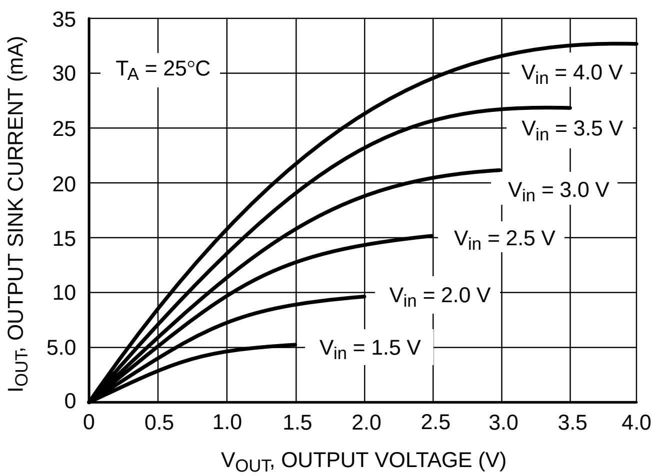


Figure 10. NCP300L/1L Series 4.5 V Reset Output Sink Current versus Output Voltage

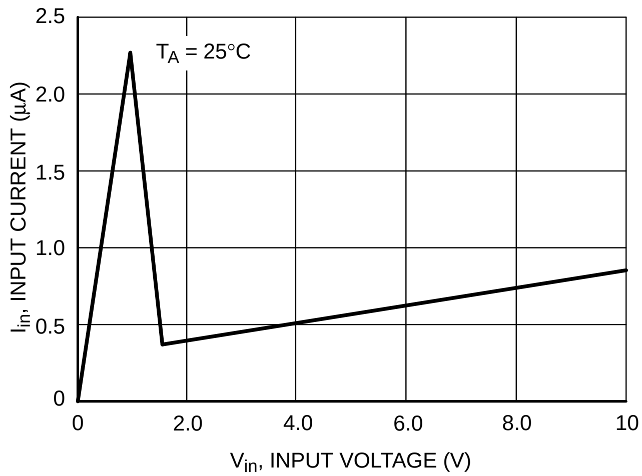


Figure 11. NCP300/1 Series 0.9 V Input Current versus Input Voltage

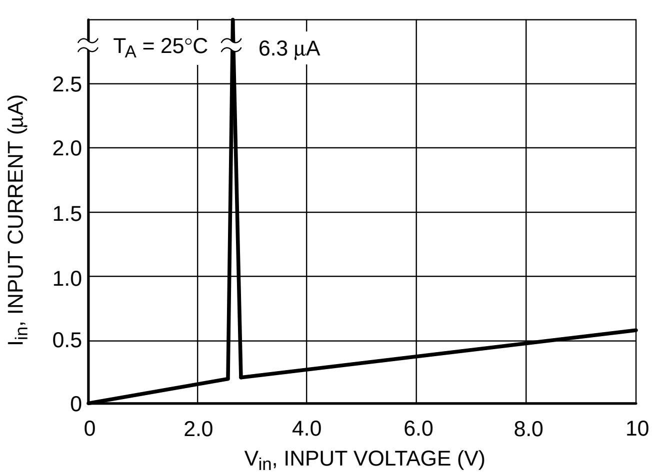


Figure 12. NCP300/1 Series 2.7 V Input Current versus Input Voltage

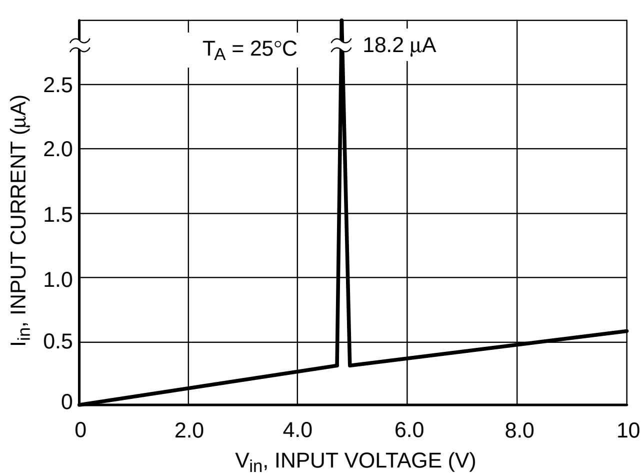


Figure 13. NCP300/1 Series 4.5 V Input Current versus Input Voltage

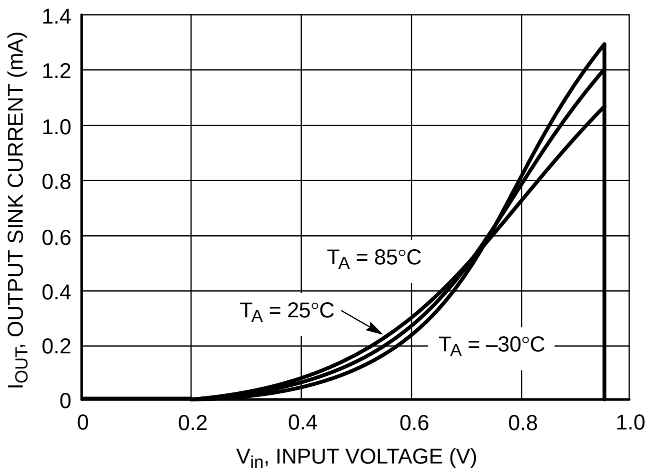


Figure 14. NCP300L/1L Series 0.9 V Reset Output Sink Current versus Input Voltage

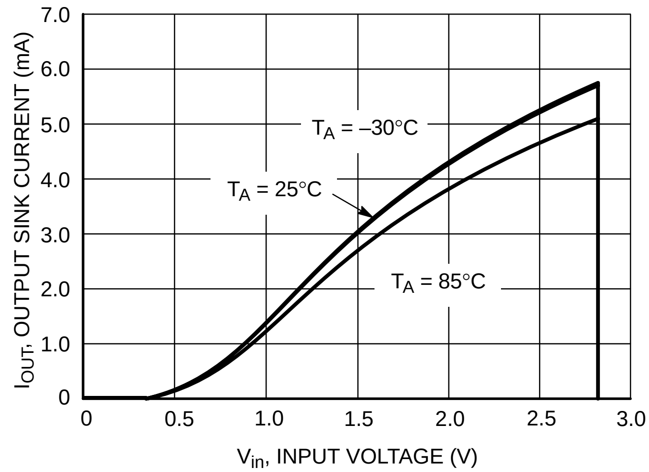


Figure 15. NCP300L/1L Series 2.7 V Reset Output Sink Current versus Input Voltage

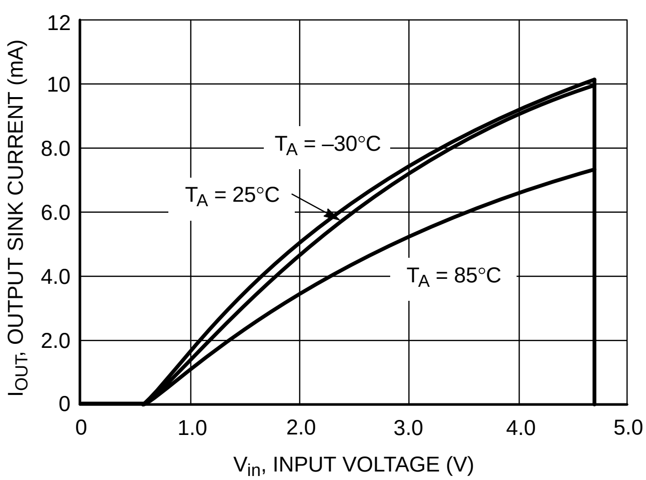


Figure 16. NCP300L/1L Series 4.5 V Reset Output Sink Current versus Input Voltage

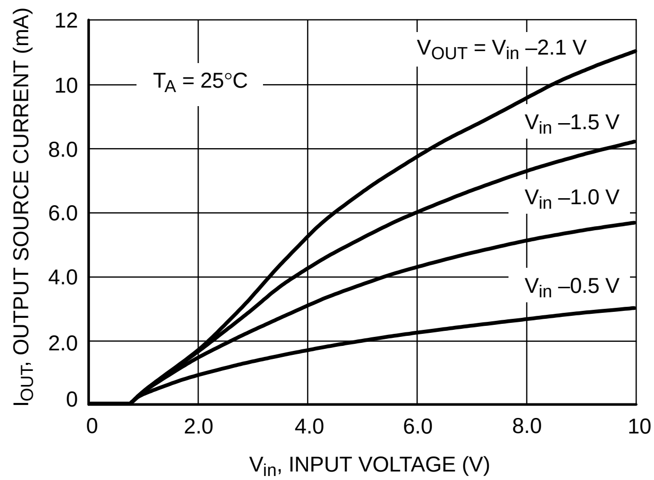


Figure 17. NCP300L Series 0.9 V Reset Output Source Current versus Input Voltage

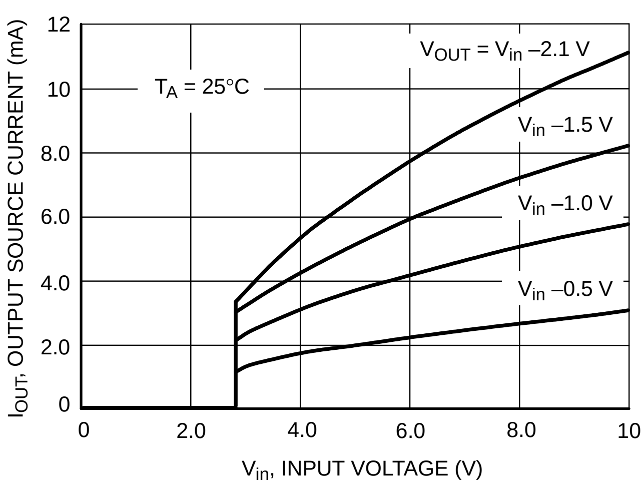


Figure 18. NCP300L Series 2.7 V Reset Output Source Current versus Input Voltage

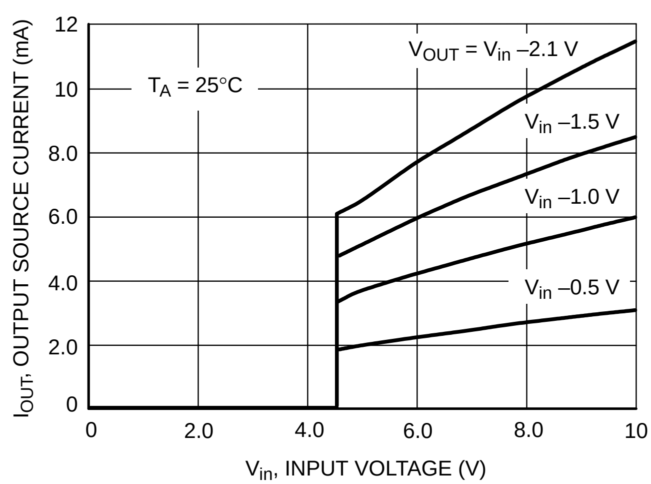


Figure 19. NCP300L Series 4.5 V Reset Output Source Current versus Input Voltage

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 21 through Figure 28 shows various application examples.

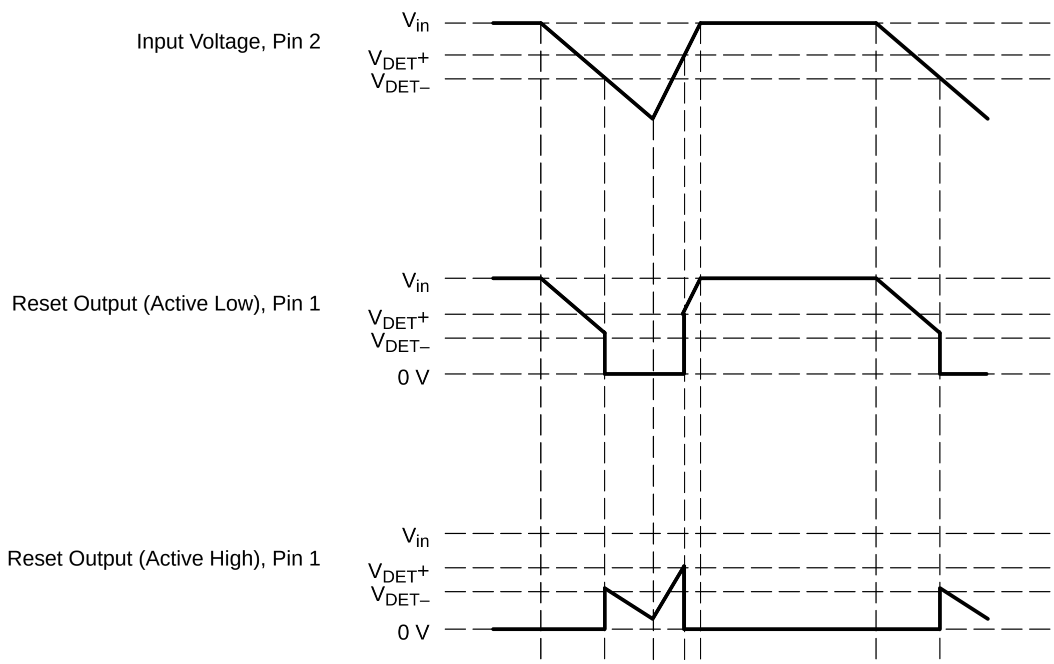


Figure 20. Timing Waveforms

APPLICATION CIRCUIT INFORMATION

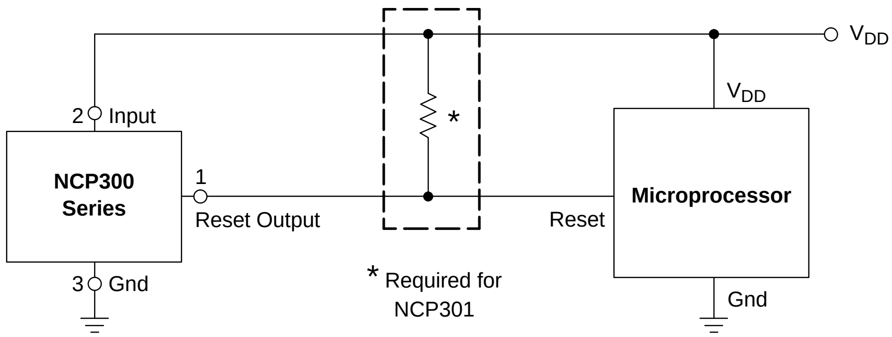


Figure 21. Microprocessor Reset Circuit

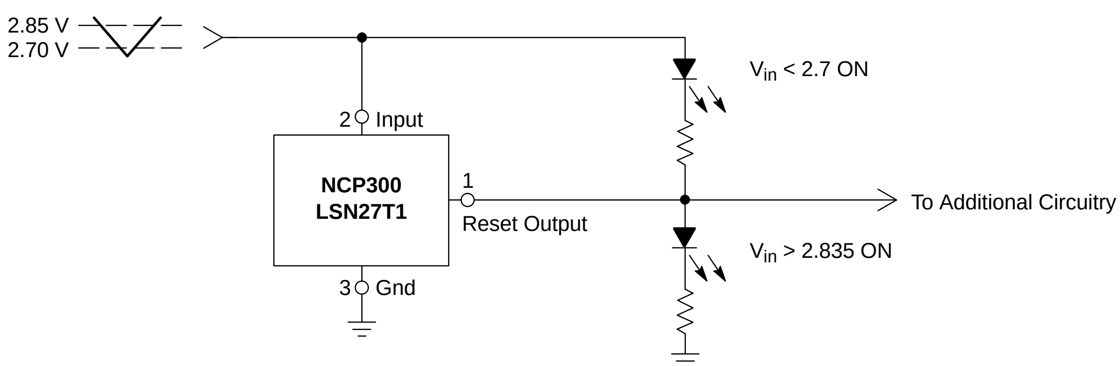
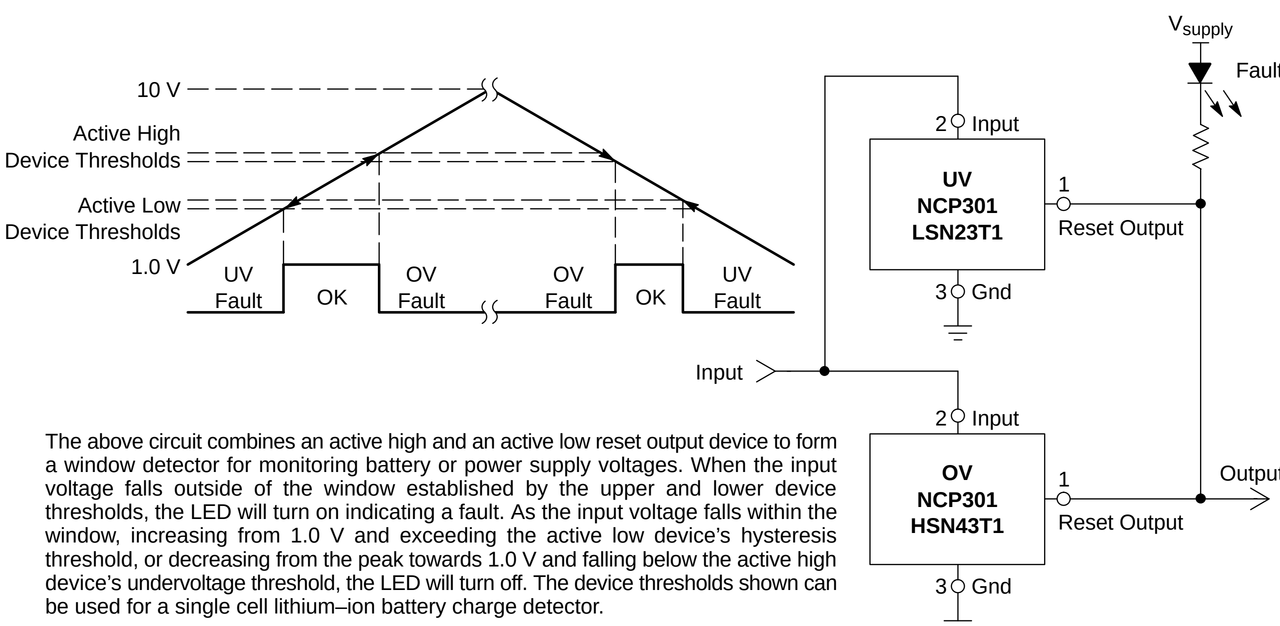


Figure 22. Battery Charge Indicator



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 23. Window Voltage Detector

APPLICATION CIRCUIT INFORMATION

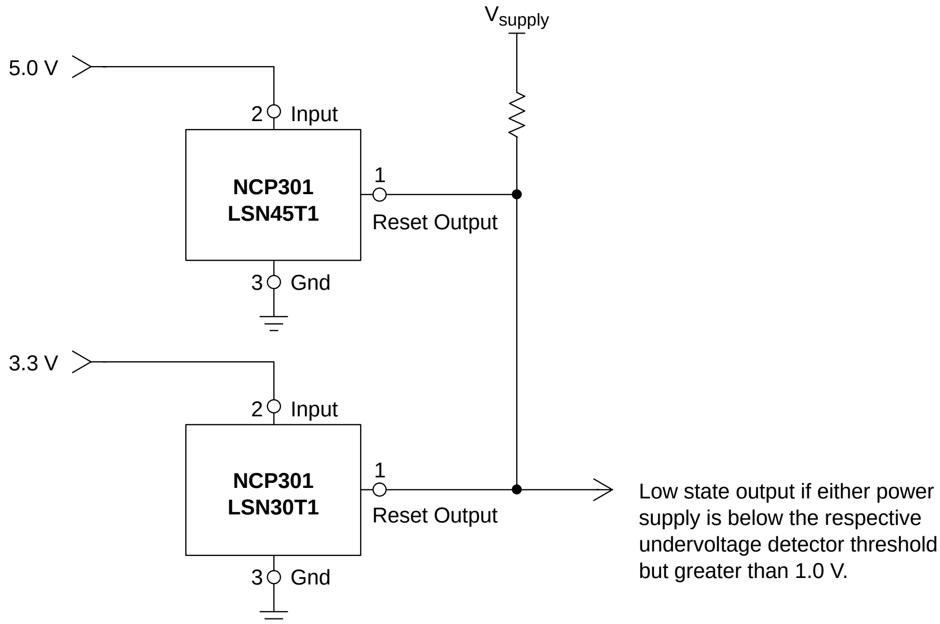


Figure 24. Dual Power Supply Undervoltage Supervision

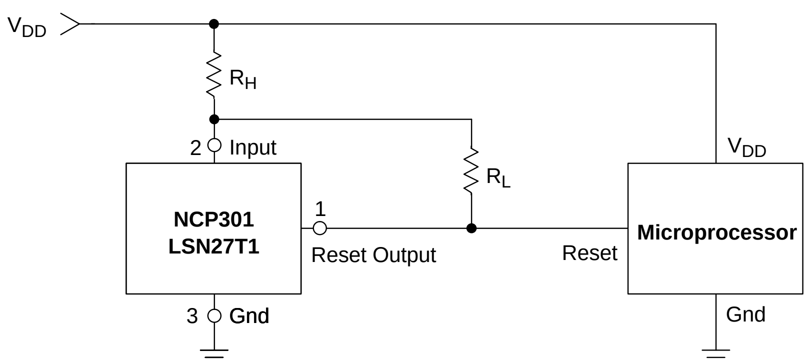


Figure 25. Microprocessor Reset Circuit with Additional Hysteresis

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:

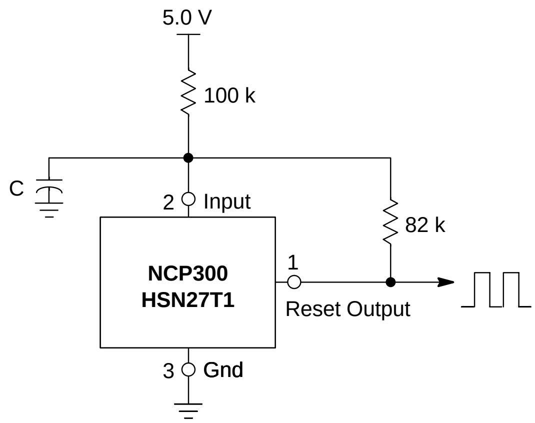
$$V_{th} = \left(\frac{R_H}{R_{in}} + 1\right)\left(V_{DET-}\right)$$

V_{in} Increasing:

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

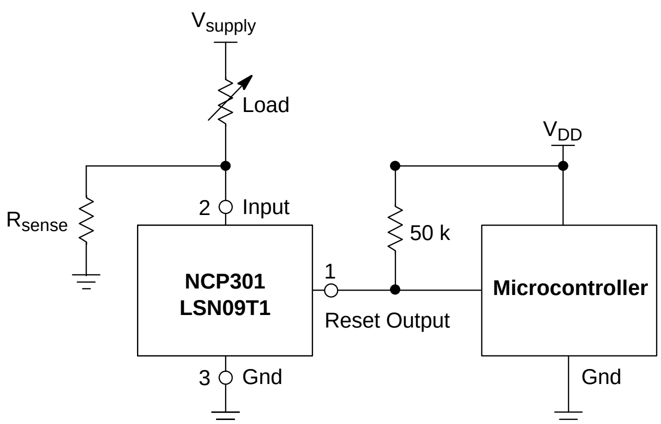
V_{HYS} = V_{in} Increasing – V_{in} Decreasing

Test Data				
V_{th} Decreasing (mV)	V_{th} Increasing (mV)	V_{HYS} (mV)	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	0.19	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

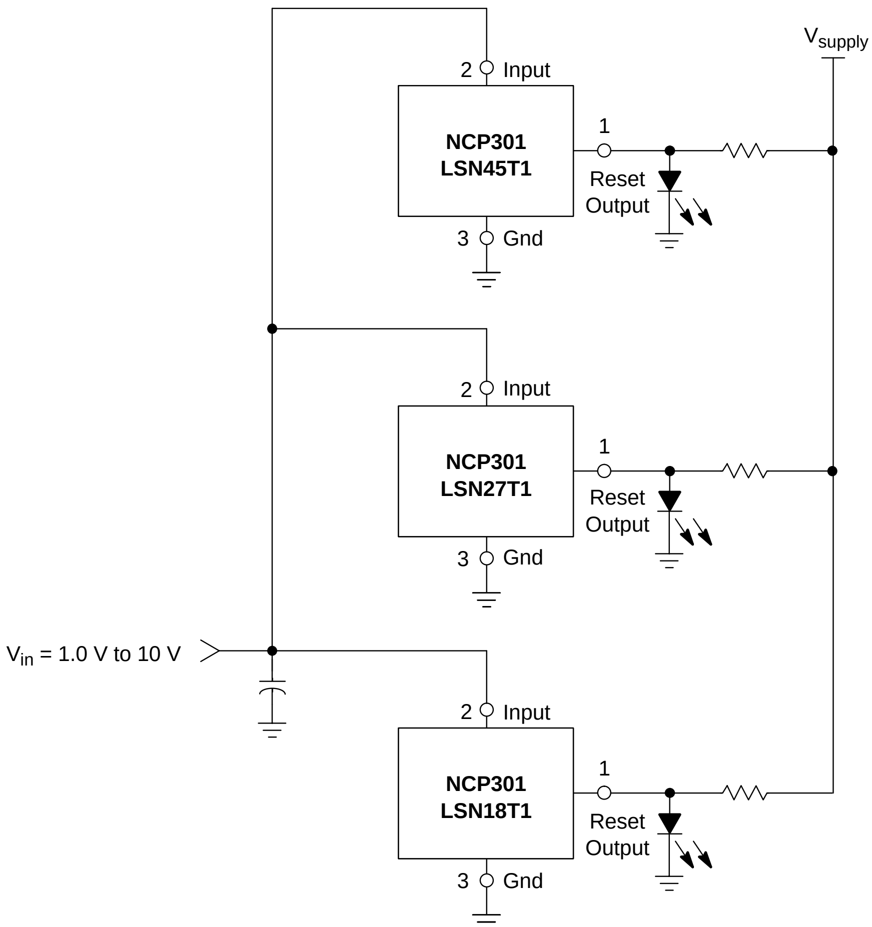
Figure 26. Simple Clock Oscillator



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 27. Microcontroller System Load Sensing

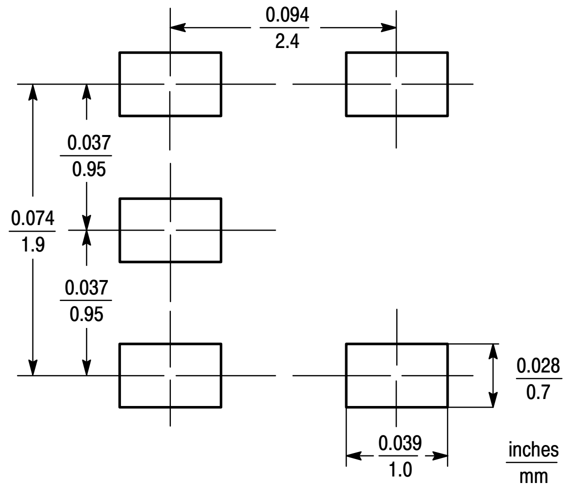


A simple voltage monitor can be constructed by connecting several voltage detectors as shown above. Each LED will sequentially turn on when the respective voltage detector threshold (V_{DET-} +V_{HYS}) is exceeded. Note that detector thresholds (V_{DET-}) that range from 0.9 V to 4.9 V in 100 mV steps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

Figure 28. LED Bar Graph Voltage Monitor

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to insure proper solder connection interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



TSOP–5

(Footprint Compatible with SOT23–5)

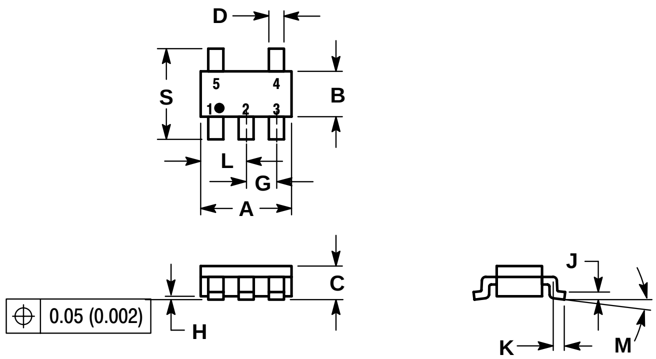
ORDERING INFORMATION

Device	Threshold Voltage	Output Type	Reset	Marking	Package (Qty/Reel)
NCP300LSN09T1	0.9	CMOS	Active Low	SEJ	3000 Units on 7 inch Reel
NCP300LSN18T1	1.8			SFK	
NCP300LSN20T1	2.0			SEH	
NCP300LSN27T1	2.7			SEE	
NCP300LSN30T1	3.0			SEC	
NCP300LSN45T1	4.5			SEA	
NCP300LSN47T1	4.7			SDZ	
NCP300HSN09T1	0.9		Active High	SDY	
NCP300HSN18T1	1.8			SFJ	
NCP300HSN20T1	2.0			SFI	
NCP300HSN27T1	2.7			SDU	
NCP300HSN30T1	3.0			SDS	
NCP300HSN45T1	4.5			SDQ	
NCP300HSN47T1	4.7			SDP	
NCP301LSN09T1	0.9	Open Drain	Active Low	SFF	
NCP301LSN18T1	1.8			SFN	
NCP301LSN20T1	2.0			SFD	
NCP301LSN27T1	2.7			SFA	
NCP301LSN30T1	3.0			SEY	
NCP301LSN45T1	4.5			SEV	
NCP301LSN47T1	4.7			SEU	
NCP301HSN09T1	0.9		Active High	SET	
NCP301HSN18T1	1.8			SFM	
NCP301HSN20T1	2.0			SFL	
NCP301HSN27T1	2.7			SEP	
NCP301HSN30T1	3.0			SEN	
NCP301HSN45T1	4.5			SEL	
NCP301HSN47T1	4.7			SEK	

NOTE: The ordering information lists seven standard under voltage 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 μV 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.

PACKAGE DIMENSIONS

TSOP–5
SN SUFFIX
PLASTIC PACKAGE
CASE 483–01
ISSUE A



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.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.90	3.10	0.1142	0.1220
B	1.30	1.70	0.0512	0.0669
C	0.90	1.10	0.0354	0.0433
D	0.25	0.50	0.0098	0.0197
G	0.85	1.00	0.0335	0.0413
H	0.013	0.100	0.0005	0.0040
J	0.10	0.26	0.0040	0.0102
K	0.20	0.60	0.0079	0.0236
L	1.25	1.55	0.0493	0.0610
M	0°	10°	0°	10°
S	2.50	3.00	0.0985	0.1181

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