

ON Semiconductor

Is Now

onsemi™

To learn more about onsemi™, please visit our website at
www.onsemi.com

onsemi and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.



Detection Voltage Selection Guidelines for Application of NCP30X Family Series

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NCP30X	Voltage Supervisory Rest IC	N/A	N/A	N/A	N/A

Circuit Description

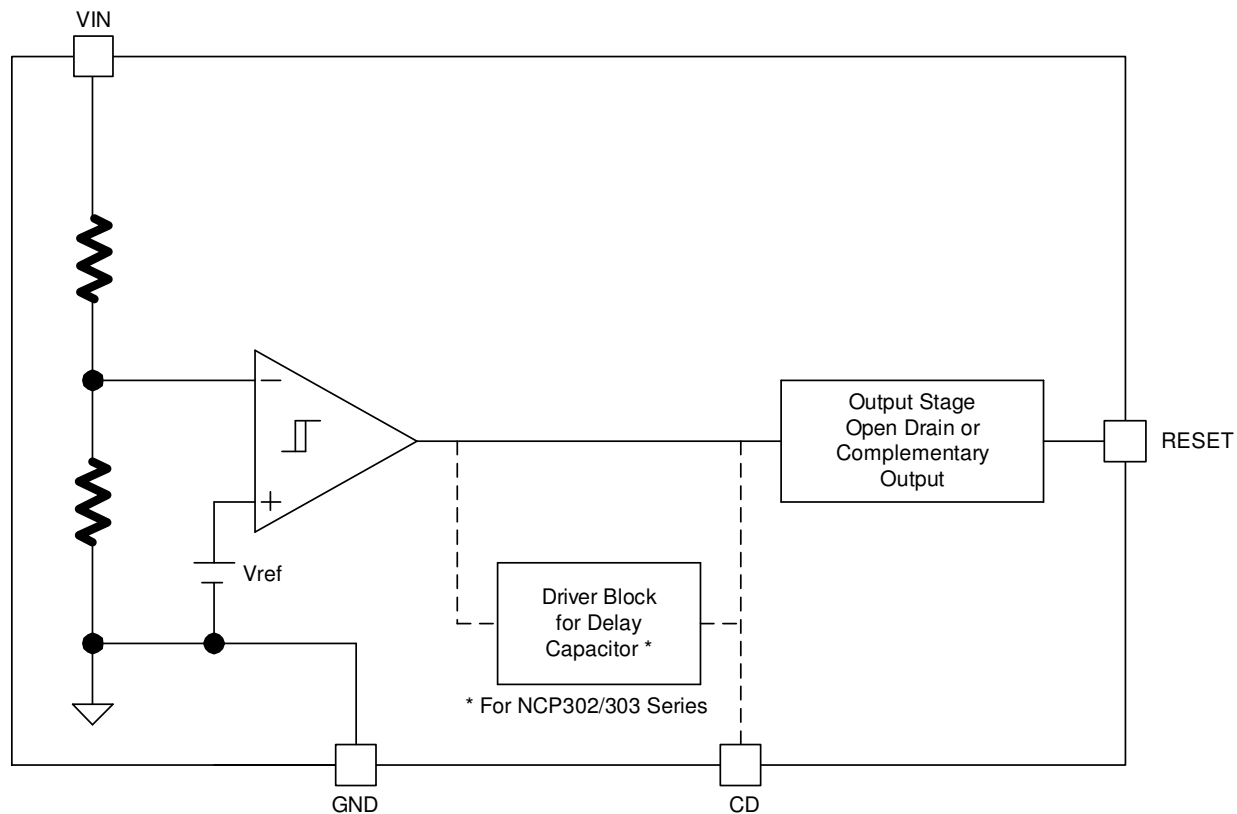


Fig 1. General block diagram of NCP30X family series

The Fig 1. shows the basic block diagram of NCP30X supervisory family series. It features a highly accurate undervoltage detector with hysteresis. Some parts also feature an externally programmable time delay generator by adding a delay capacitor at the CD pin. This combination of features prevents the system from erratic reset operation.

DN06060/D

To guarantee the microprocessor (uP) operating normally, the power supply should be well monitored by using voltage monitor device such as NCP30X. In order to make sure that the uP RESET input is asserted when the power supply is not ready and, RESET pin is de-asserted for normal operation when power supply voltage reaches above the minimum operating range of Vcc input.

This document demonstrates the guideline how to select NCP30X detection voltage option based on the given system parameters.

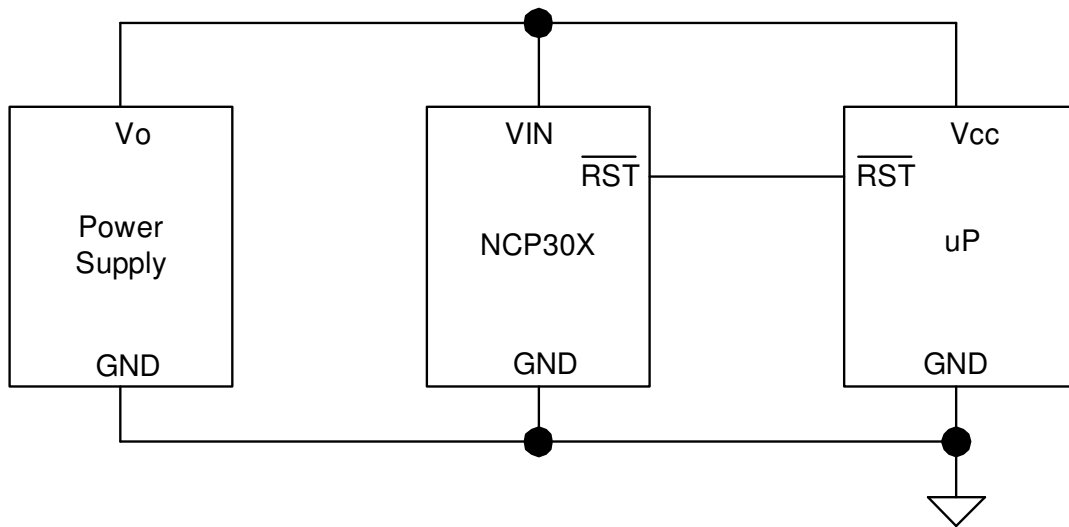


Fig 2. Typical System Configuration Using with Supervisory Device

The configuration in the Fig 2 shows how the power supply connects to uP under the voltage monitoring by NCP30X device. To make sure that uP is in normal operation, typically the voltage % tolerance of the power supply must be tighter than that of the uP. For example, if the uP's VCC voltage tolerance (it can be found in uP's DC electrical specification at data sheet) is +/- 5%, then the power supply % tolerance should be less than 5%, say, for example 3%.

NCP30X Detection Voltage Selection Criteria

For selecting the NCP30X detection voltage option, basically there are three major factors to be considered:-

1. Vdet+_max = Maximum detection voltage (VIN rises) of the NCP30X.
2. Vin_min = Minimum voltage output of the power supply.
3. Vcc_min = Minimum voltage input of the device (powered by supply Vin) that can normally operate.

For the Vdet+_max, it can be given by the following formula:-

$$V_{det+_{max}} = V_{det-_{max}} + V_{hys_{max}} \dots\dots\dots (1)$$

Where:

Vdet-_max = Maximum detector threshold voltages

Vhys_max = Maximum detector threshold hysteresis

For the NCP30X family, for given Vdet-_typ typical detection voltage which reflects on the part number at data sheet, the device's threshold values are designed to the following targets (at 25°C)

$$V_{det-_{min}} = V_{det-_{typ}} - 2\% \dots\dots\dots (2)$$

$$V_{det-_{max}} = V_{det-_{typ}} + 2\% \dots\dots\dots (3)$$

$$V_{hys_{typ}} = 5\% \text{ of } V_{det-_{typ}} \dots\dots\dots (4)$$

$$V_{hys_{min}} = V_{hys_{typ}} - 40\% \dots\dots\dots (5)$$

$$V_{hys_{max}} = V_{hys_{typ}} + 40\% \dots\dots\dots (6)$$

The below table shows how those information can be found in the data sheet:

NCP300 Series	Detector Threshold			Detector Threshold Hysteresis		
	V _{DET-} (V) (Note 4)					
Part Number	Min	Typ	Max	Min	Typ	Max
NCP300LSN09T1	0.882	0.9	0.918	0.027	0.045	0.063
NCP300I SN18T1	1.764	1.8	1.836	0.054	0.090	0.126

DN06060/D

By simple mathematical re-combination of equations (2) to (6), equation (1) becomes:-

$$V_{det+_{max}} = V_{et-_{typ}} * 1.09$$

So, $V_{det+_{max}}$ can be easily figure out by just using a single variable V_{det_typ} .

For having the value of $V_{det+_{max}}$, the NCP30X device detection voltage option must be chosen such that:-

$$V_{cc_min} < V_{det+_{max}} < V_{in_min}$$

The physical meaning of $V_{cc_min} < V_{det+_{max}}$ is that it makes sure the reset from NCP30X is asserted (in RESET hold state) before V_{in} supply becomes higher than V_{cc_min} for prevention from incorrect device (uP) initialization.

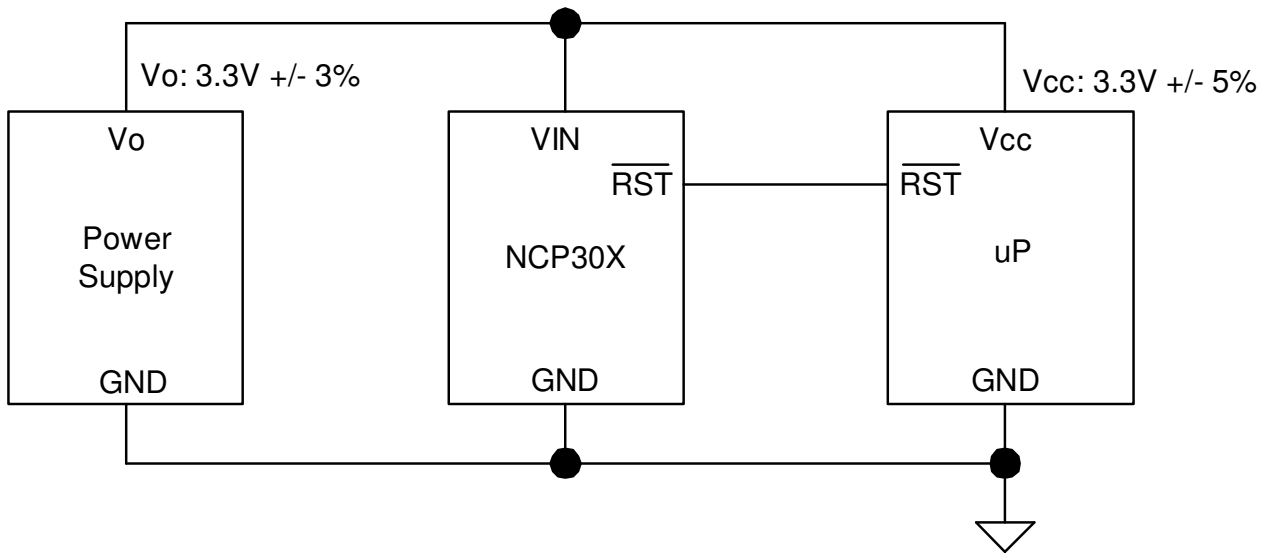
For the $V_{det+_{max}} < V_{in_min}$, it makes sure the NCP30X is able to start up even though V_{in} is at the V_{in_min} .

Theoretically speaking, by principle of two points averaging, the ideal detection voltage threshold value, $V_{det_typ_ideal}$, can be given by the following formula:-

$$V_{det_typ_ideal} = (V_{in_min} + V_{cc_min}) / (2 * 1.09)$$

Example of Detection Voltage Threshold Selection Calculation

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



So, we have:-

$$\begin{aligned} V_{in_min} &= 3.3V * 0.97 \\ &= 3.201V \end{aligned}$$

$$\begin{aligned} V_{cc_min} &= 3.3V * 0.95 \\ &= 3.135V \end{aligned}$$

Recall the formula

$$V_{det_typ_ideal} = (V_{in_min} + V_{cc_min}) / (2 * 1.09)$$

$$\begin{aligned} \text{So, the ideal detection voltage option} &= (3.201 + 3.135) / (2 * 1.09) \\ &= 2.9064V \end{aligned}$$

Therefore, the device detection voltage option 2.9V should be the right choice. That is to say, customer should select the part number NCP30xxSx29T1G.

© 2009 ON Semiconductor.

Disclaimer: ON Semiconductor is providing this design note "AS IS" and does not assume any liability arising from its use; nor does ON Semiconductor convey any license to its or any third party's intellectual property rights. This document is provided only to assist customers in evaluation of the referenced circuit implementation and the recipient assumes all liability and risk associated with its use, including, but not limited to, compliance with all regulatory standards. ON Semiconductor may change any of its products at any time, without notice.

Design note created by Cimiyan Chan, e-mail: Cimiyan.chan@onsemi.com