Design Note – DN06060/D

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

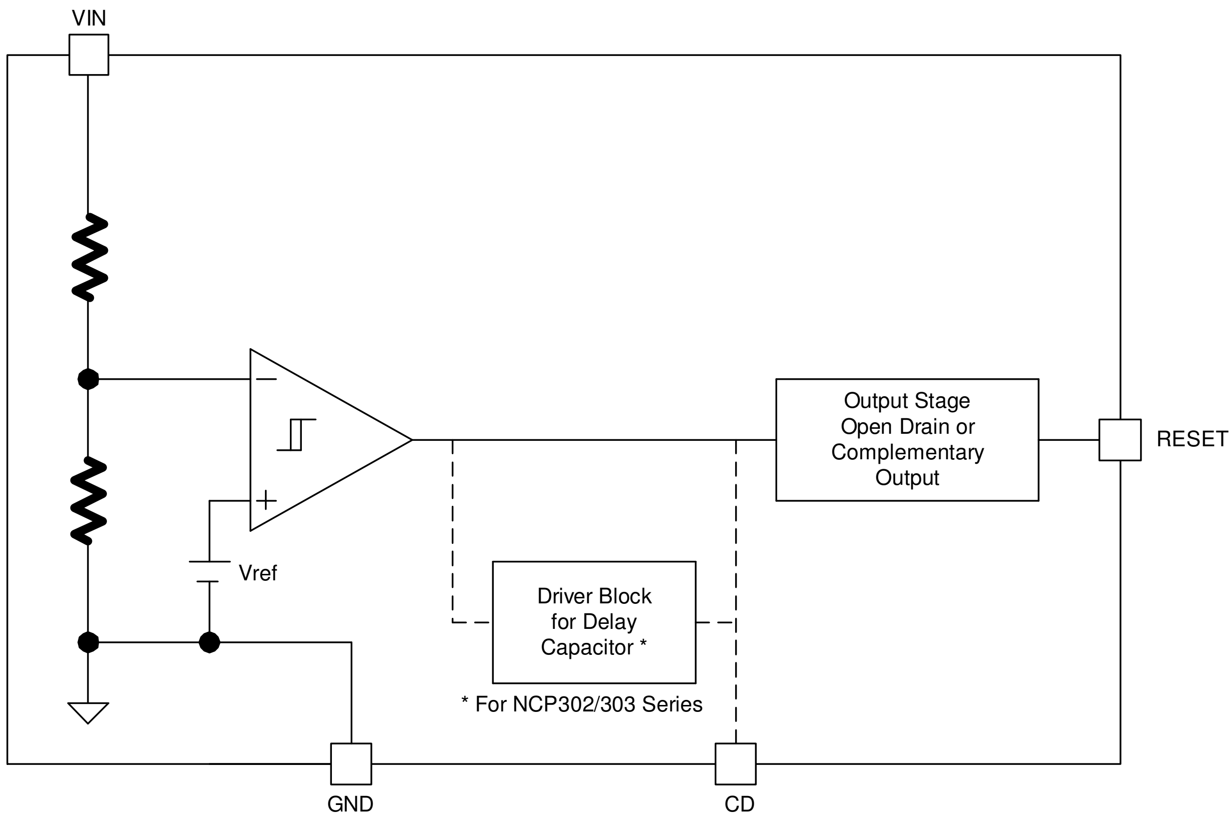


Fig 1. General block diagram of NCP30X family series

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.

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.

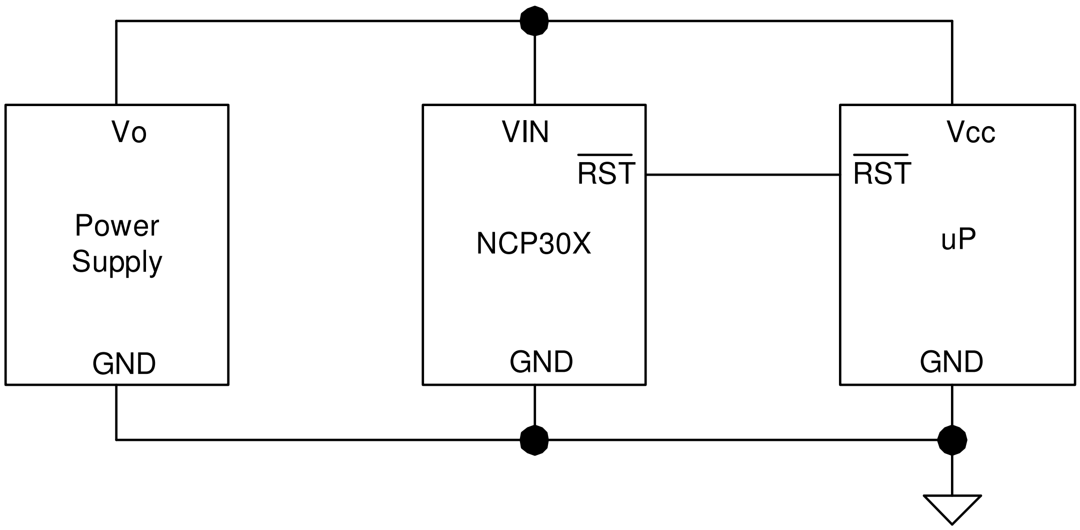


Fig 2. Typical System Configuration Using with Supervisory Device

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:-

Vdet+_max = Vdet-_max + Vhys_max ……………….. (1)

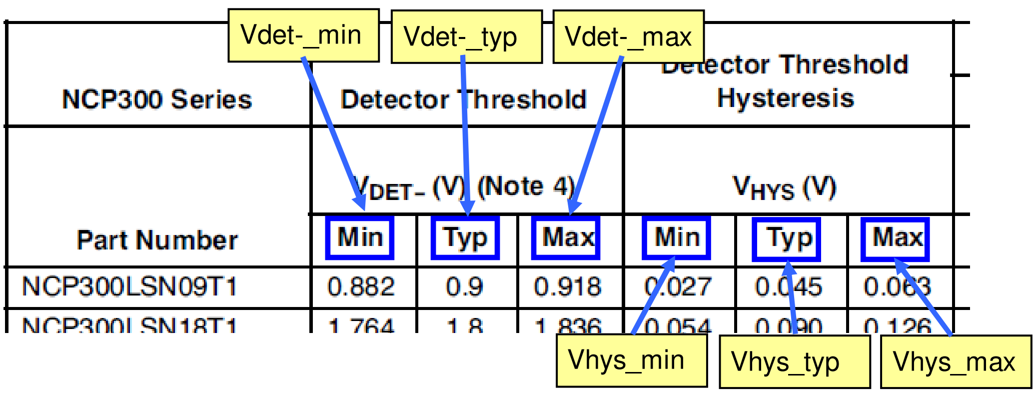
Where:
Vdet-_max = Maximum detector threshold voltages
Vhys_max = Maximum detector threshold hysteresis

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 25ºC)

Vdet-_min = Vdet-_typ – 2% …………………….. (2)
Vdet-_max = Vdet-_typ + 2% …………………….. (3)

Vhys_typ = 5% of Vdet-_typ …………………….. (4)
Vhys_min = Vhys_typ – 40% …………………….. (5)
Vhys_max = Vhys_typ + 40% …………………….. (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)			V_{HYS} (V)		
Part Number	Min	Typ	Max	Min	Typ	Max
NCP300LSN09T1	0.882	0.9	0.918	0.027	0.045	0.063
NCP300LSN18T1	1.764	1.8	1.836	0.054	0.090	0.126

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

$$\boxed{Vdet+\_max = Vet-\_typ * 1.09}$$

So, Vdet+_max can be easily figure out by just using a single variable Vdet_typ.

For having the value of Vdet+_max, the NCP30X device detection voltage option must be chosen such that:-

$$\boxed{Vcc\_min < Vdet+\_max < Vin\_min}$$

The physical meaning of Vcc_min < Vdet+_max is that it makes sure the reset from NCP30X is asserted (in RESET hold state) before Vin supply becomes higher than Vcc_min for prevention from incorrect device (uP) initialization.

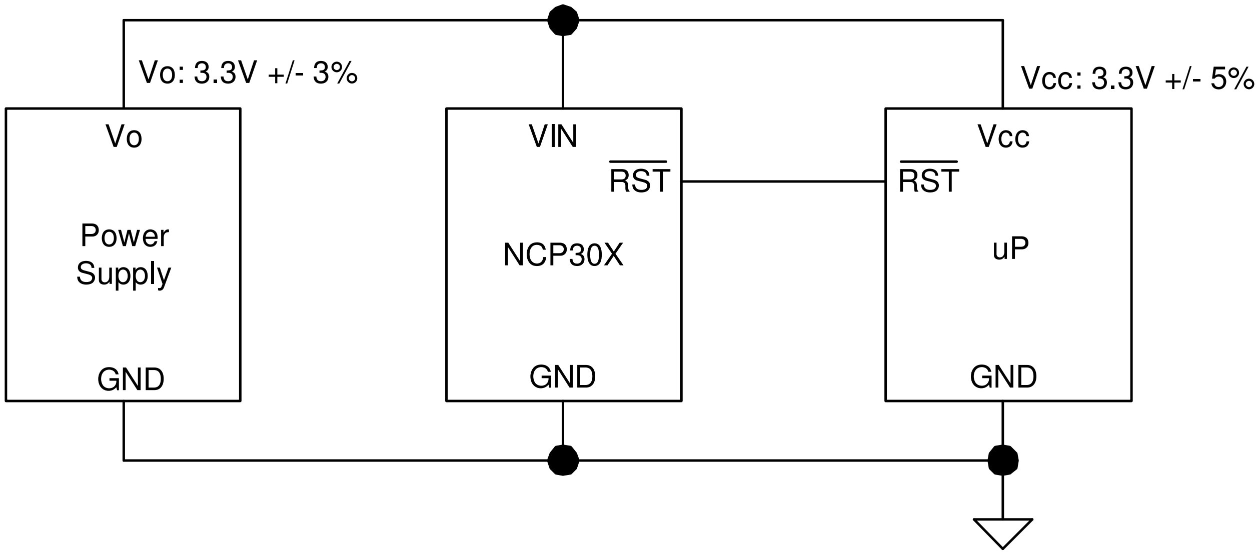
For the Vdet+_max < Vin_min, it makes sure the NCP30X is able to start up even though Vin is at the Vin_min.

Theoretically speaking, by principle of two points averaging, the ideal detection voltage threshold value, Vdet-_typ_ideal, can be given by the following formula:-

$$\boxed{Vdet-\_typ\_ideal = (Vin\_min + Vcc\_min) / (2 * 1.09)}$$

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:-

Vin_min = 3.3V * 0.97
= 3.201V

Vcc_min = 3.3V * 0.95
= 3.135V

Recall the formula

$$\boxed{\text{Vdet-\_typ\_ideal} = (\text{Vin\_min} + \text{Vcc\_min}) / (2 * 1.09)}$$

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

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

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