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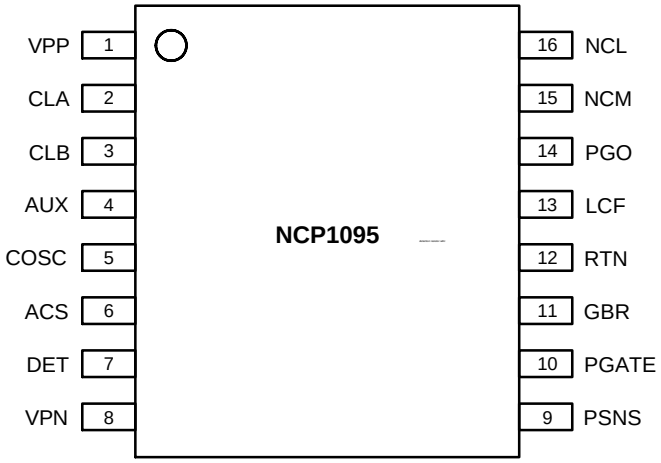


Figure 1. Pin-out NCP1095 in 16-pin TSSOP (Top View)

PIN DESCRIPTION

Signal Name	Pin No.	Type	Description
VPP	1	Power	Positive input power. Connect to the positive terminal of the rectifier bridge
CLA	2	Output	Connect a class signature programming resistor to VPN. See classification section for recommended values
CLB	3	Output	
AUX	4	Input	Auxiliary supply detection input. Referenced to VPN
COSC	5	Analog	Connect a 1 nF capacitor between COSC and VPN. This pin is pulled to VPP during the detection phase
ACS	6	Input	Autoclass enable/disable input. Pull to VPN to disable Autoclass; leave floating to enable Autoclass
DET	7	Output	Connect a 26.1 kΩ detection resistor between DET and COSC. This pin is pulled to VPN during the detection phase
VPN	8	Power, Ground	

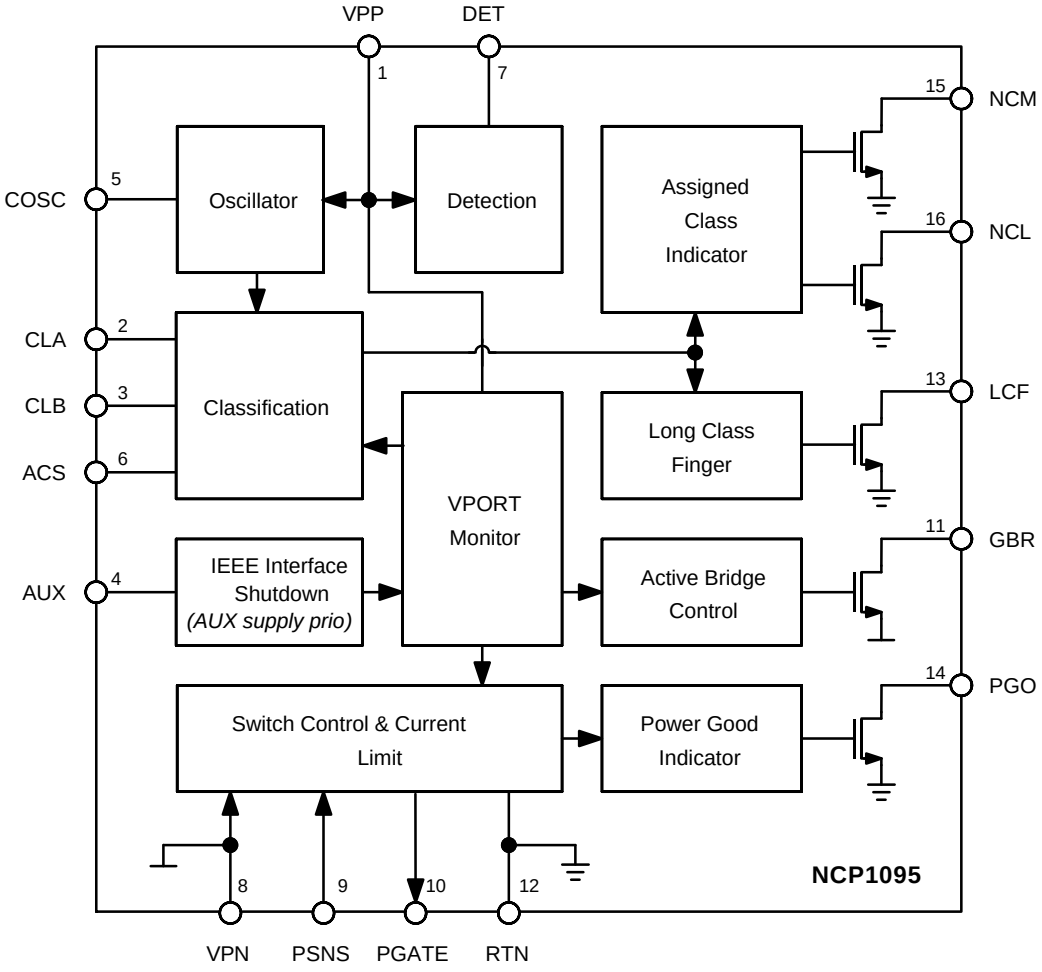


Figure 2. NCP1095 Block Diagram

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min

ELECTRICAL CHARACTERISTICS

(All parameters are guaranteed for the recommended operating conditions unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Unit	Condition
DETECTION CHARACTERISTICS						
Rdetect	Equivalent detection resistance	23.7		26.3	kΩ	R_{DET} = 26.1 kΩ 1%; 1 V, V_{PORT}, 10.1 V
VoffsetIC	Detection offset voltage (IC part)	0		0.2	V	
CLASISFICATION CHARACTERISTICS						
Vcl_th	Class/Mark current switchover threshold (Note 5)	10.1		12.5	V	V_{PORT} rising or falling
Vcldis	Classification current disable threshold (Note 5)	20.5		24.5	V	V_{PORT} rising or falling
Iclsigq	Quiescent current during classification	207	327	484	μA	V_{PORT} = 12.5 V
Vcsr	CLASS driver voltage (Note 5) during class event	8.5	9.15	9.7	V	12.5 V, V_{PORT}, 20.5 V
Iclsig0	RclassA,B = 4.5 kΩ 1%	1		4	mA	12.5 V, V_{PORT}, 20.5 V
Iclsig1	RclassA,B = 909 Ω 1%	9		12	mA	12.5 V, V_{PORT}, 20.5 V
Iclsig2	RclassA,B = 511 Ω 1%	17		20	mA	12.5 V, V_{PORT}, 20.5 V
Iclsig3	RclassA,B = 332 Ω 1%	26		30	mA	12.5 V, V_{PORT}, 20.5 V
Iclsig4	RclassA,B = 232 Ω 1%	36		44	mA	12.5 V, V_{PORT}, 20.5 V
Imark	IPP during mark event range	1	2.3	4	mA	4.9 V, V_{PORT}, 10.1 V
tfce						

ELECTRICAL CHARACTERISTICS (continued)
(All parameters are guaranteed for the recommended operating conditions unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Unit	Condition
AUXILIARY SUPPLY DETECTION CHARACTERISTICS						
AUX_H	AUX input high level voltage (Note 5)	1.7	2.15	2.6	V	
AUX_L	AUX input low level voltage (Note 5)	0.5	0.75	1.05	V	

SIMPLIFIED APPLICATION SCHEMATIC

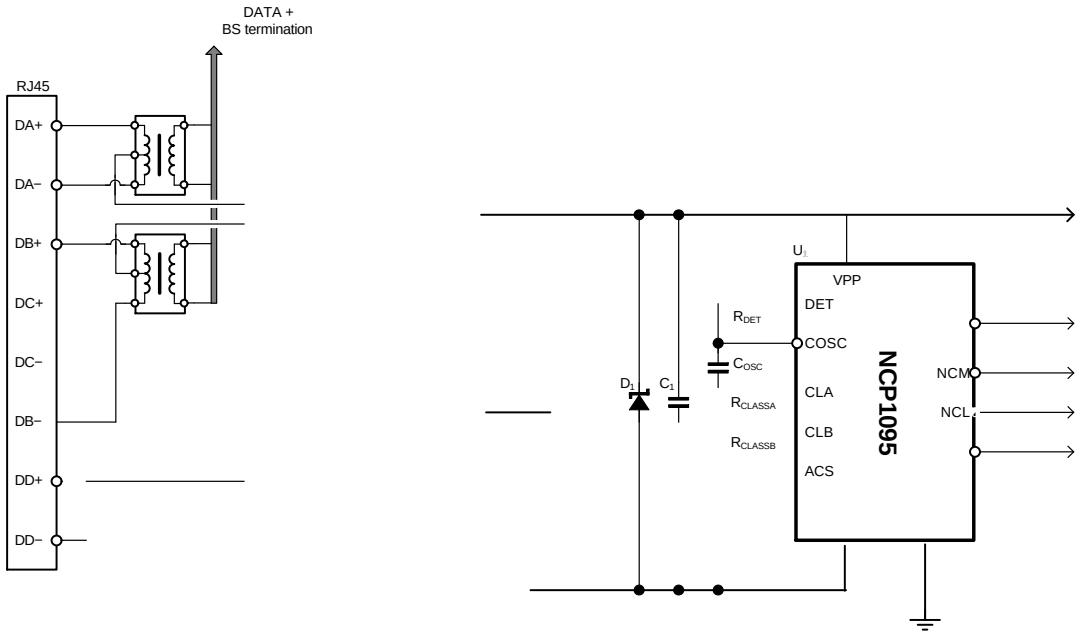


Figure 3. General Application Schematic

APPLICATION INFORMATION

Inrush Current Limiting

When the PSE has successfully assigned the PD to a specific Class in correspondence with the power the PSE is able to deliver, the PSE will increase the voltage at its power interface up to its internal power supply voltage. NCP1095 will enter the inrush current control state once its port voltage rises above the UVLO_H threshold.

In this state, NCP1095 will control the charging of its port capacitance C_{PD} located between VPP and RTN by operating the pass switch transistor in the active region. The current through the pass switch is regulated by monitoring the voltage over an external sense resistor R_{SNS} = 25 mΩ. NCP1095 will limit the inrush current well below the PSE inrush threshold while charging its port capacitance. The nominal level of the inrush current is 110 mA typ. The NCP1095 will exit the inrush current control state when the voltage between RTN and VPN is smaller than 0.8 V and the gate voltage rises above 8.5 V. At this stage, the port capacitance can be considered to be fully charged, and NCP1095 will enter the normal operation mode with the pass switch completely turned on.

If the port capacitance voltage remains low due to an output short error condition, the inrush current control state will be aborted to protect the pass-switch. In order not to be considered as a short, the port capacitance should be chosen

NCM and NCL Indicators

The state of the NCM and NCL outputs provides information

Table 4. MPS CURRENT

Assigned Class	$I_{Port\_MPS,Min}$
4	10 mA
5	16 mA

An important remark is that the PD load current will be low-pass filtered by its port capacitance and the actual resistance of the cable. This should be taken into account when generating current pulses for MPS.

The PD needs to maintain the MPS as soon as its port voltage rises above the UVLO_H threshold. Depending on the amount of port capacitance and the type of PSE it is connected to, the time duration of the inrush current control state might or might not be enough ($T_{MPS\_PD,Min}$) to count as the first valid current pulse. In combination with 3bt PSEs this will usually not be a problem as it typically takes 7 ms to charge just a 14.4 μF cap to 50 V. In combination with 3af/at PSEs the situation is different as it typically takes 75 ms to charge a 176 μF cap to 44 V.

Autoclass

802.3bt foresees an optional extension of classification known as Autoclass. This allows a 3bt certified PSE to better allocate its power among different PDs.

When the ACS pin is connected to VPN, Autoclass is disabled.

When the ACS pin is left floating, Autoclass is enabled and NCP1095 will request an Autoclass measurement to a 3bt type of PSE during classification. If Autoclass is enabled and the LCF output is low, the system must go to the maximum power state according to its assigned Class no later than 1.35 s after power has been applied, and keep the maximum load active until at least 3.65 s after power has been applied. During this period, the PSE will measure the maximum power draw of the PD and allocate this amount of power to the PD.

Peak Power and Transients

Although the PoE standard allows the PD to draw slightly higher peak power during a short time, making use of this is not recommended. It is best to keep this additional margin only to be able to withstand voltage transients on the PSE side. The required recovery time for transients also limits the amount of the port capacitance that can be used.

Under Voltage Lockout

If the port voltage falls below the UVLO_L threshold and remains low for a sufficient amount of time, NCP1095 will enter the poweroff state and turn off the pass switch.

Once the port voltage falls below the reset threshold Vrst, the NCP1095 will re−enter the idle state and can again be detected as a PD requesting power.

Operational Current Protection

In the normal operation mode, NCP1095 will monitor the current through the pass switch and provide protection against soft and hard shorts.

o874 438.962 TD711.3JT*(OCls bel6 1 Tf148Alt992 440.677 697.77182

Figure 7. Complete Start-up Diagram of a Class 8 PD with Autoclass

PoE System Overview

The overall PoE standard distinguishes between four Types of PSEs and four Types of PDs.

- Type 1 PSEs and PDs behave according to 802.3af/at
- Type 2 PSEs and PDs behave according to 802.3at
- Type 3 and 4 PSEs and PDs behave according to 802.3bt

Table 5 gives an overview of the system parameters that are allowed and required for operation at a certain power level (assigned Class).

An important parameter is the cable DC resistance (determined by cable type and length).

In general a Cat 5 cable is required when using a Type 3 or Type 4 PD or PSE in the system or when both PSE and PD are of Type 2.

Operation over 4-pair is reserved for Type 3 and 4 PSEs.

Table 5. SYSTEM PARAMETERS OVERVIEW

Assigned Class	PSE Type	Minimum Cabling Type	Number of Powered Pairs	PD Type	Requested Class	Standard
1	1	Cat 3 (Note 9)	2p	1	1	802.3af/at
	2	Cat 3				
	3, 4	Cat 3	2p/4p	3		802.3bt
2	1, 2	Cat 3	2p	1	2	802.3af/at
	3	Cat 5 (Note 10)	2p/4p	3		802.3bt
	4	Cat 5				
3	1	Cat 3	2p	1	0, 3	802.3af
	1	Cat 3 (Note 11)	2p	1	0, 3	802.3at
				2	4	
	2	Cat 3		1	0, 3	802.3af/at
				2	4	802.3at
	3, 4	Cat 5	2p/4p	3	3, 4/5/6	802.3bt
				4	7/8	
4	2	Cat 5	2p	2	4	802.3at
	3, 4		2p/4p	3	4/5/6	802.3bt
				4	7/8	
5	3, 4	Cat 5	4p	3	5	802.3bt
6	3, 4	Cat 5	4p	3	6	802.3bt
				4	7, 8	
7	4	Cat 5	4p	4	7	802.3bt
8	4	Cat 5	4p	4	8	802.3bt

9. Critical for: 44 V/4 W source connected to 3.84 W load over 20 Ω.
10. Critical for: 50 V/6.7 W source connected to 6.49 W load over 12.5 Ω.
11. Critical for: 44 V/15.4 W source connected to 13 W load over 20 Ω.

Auxiliary Supply

SIMPLIFIED APPLICATION SCHEMATIC WITH AUXILIARY SUPPLY

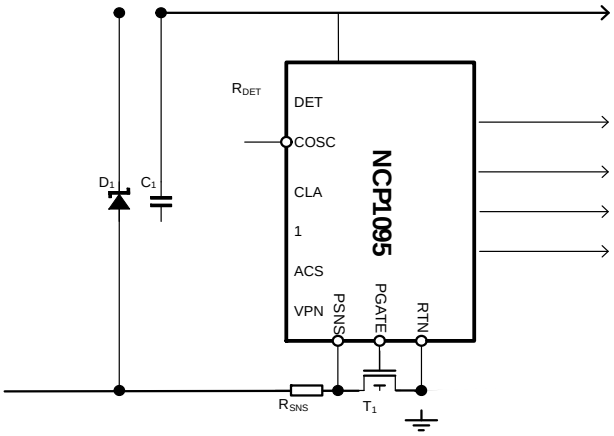
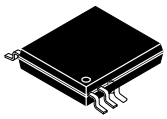


Figure 9. General Application Schematic with Auxiliary Supply

TSSOP−16 WB



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