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NCP1096

Description

The NCP1096 is a member of the onsemi Pn Sr of tht-0efETJrne0 -1.(fac743.38 1.7621684 T778(PoE-PD)f ted)6.7(Device PD)

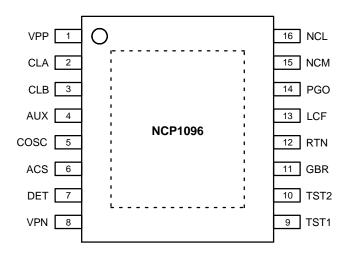


Figure 1. Pin-out NCP1096 in 16-pin TSSOP EP (Top View)

PIN DESCRIPTION

Signal Name Pin No. Type		Туре	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	See classification section for recommended values	
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 k Ω detection resistor between DET and COSC. This pin is pulled to VPN during the detection phase	
VPN	8	Power, Ground	Negative input power. Connect to the negative terminal of the rectifier bridge	
TST1	9	Input	Positive side of the internal sense resistor (and the source of the internal pass transistor). Leave floating	
TST2	10	Output	Gate of the internal pass transistor. Leave floating	
GBR	11	Output, Open Drain	Control output to disable the active rectifier bridge. This pin is referenced to VPN	
RTN	12	Power	Return connection of the PGO, NCM, NCL and LCF outputs. Connect to the DC/DC controller power return.	
	EP	Power	Exposed pad (thermal contact). Drain of the internal pass transistor. Connect to the DC/DC controller power return plane.	
LCF	13	Output, Open Drain	Long Classification Finger Indicator. This pin is referenced to RTN. Connect with a pull-up resistor to the logic supply	
PGO	14	Output, Open Drain	Power Good Indicator. This pin is left floating when the power good signal is active. Referenced to RTN. Must be used to enable/disable the main DC/DC converter adjacent to NCP1096.	
NCM	15	Output, Open Drain	Class result MSB output. This pin is referenced to RTN. Connect with a pull-up resistor to the logic supply	
NCL	16	Output, Open Drain	Class result LSB output. This pin is referenced to RTN. Connect with a pull-up resistor to the logic supply	

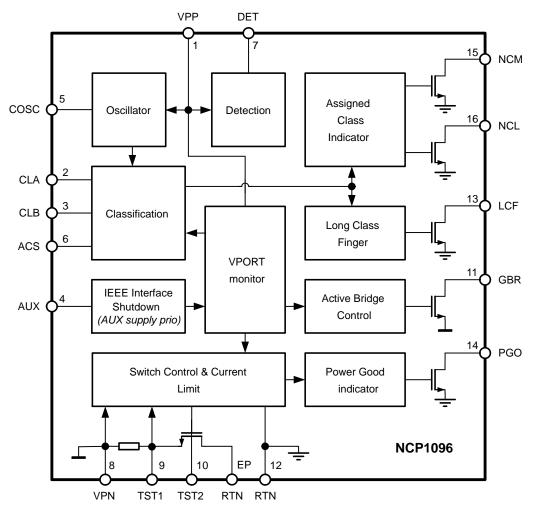


Figure 2. NCP1096 Block Diagram

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min	Max	Unit	Conditions
Τ _J	Junction temperature	-40	+150	°C	
Τ _S	Storage temperature	-55	+150	°C	
VPP	Input Power Supply	-0.3	72 (Note 2)	V	Voltage with respect to VPN
RTN	Pass switch drain connection, application ground	-0.3	72 (Note 2)	V	Voltage with respect to VPN, Pass switch in the off state
DET	Voltage on pin DET	-0.3	3.6	V	
PGO	Power Good output	-0.3	72	V	Voltage with respect to RTN
NCM	Class result MSB output				
NCL	Class result LSB output				
LCF	Long Class Finger output				
ACS	Voltage on AUTOCLASS pin	-0.3	72	V	Voltage with respect to VPN
CLA, CLB	Voltage on CLASSA or CLASSB pins				
GBR	Active bridge control output	1			
COSC	Voltage on pin COSC	1			
AUX	Auxiliary supply detection input				
ESD-HBM	Human Body Model	2		kV	Per EIA–JESD22–A114 standard
ESD-CDM	Charged Device Model	500		V	Per ESD-STM5.3.1 standard

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.

2. NCP1096 tolerates transient overvoltages from the capacitor and/or TVS subjected to a surge according to IEC 61000-4-5.

For extremely high cable discharge and surge protection, contact onsemi.

THERMAL CHARACTERISTICS (Note 3)

Symbol	Characteristic	Typical Value	Unit
θ_{JA}	Thermal Resistance, Junction-to-Air	37.6	°C/W

3. θ_{JA} is obtained with 1S2P test board (1 signal – 2 plane) and natural convection. Refer to JEDEC JESD51 for details.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
TJ	Junction Temperature	-40	+125	°C
V _{PORT} (Note 4)	Input Power Supply ($V_{PORT} = V_{PP} - V_{PN}$)	0		

ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Min	Тур	Max	Unit	Condition	
DETECTION CHARACTERISTICS							
Rdetect				26.3	kΩ	$R_{\text{DET}} = 26.1 \text{ k}\Omega \pm 1\%;$	
VoffsetIC			Detection offset voltage (IC part)	0		0.2	V
CLASISFICAT	CLASISFICATION CHARACTERISTICS						
Vcl_th	I_th Class/Mark current switchover threshold (Note 5)			12.5	V	V _{PORT} rising or falling	
Vcldis	Classification current disable threshold	20.5		24.5	V	V _{PORT} rising or failing	
	(Note 5)						
Iclsigq	gq Quiescent current during classification		327	484	μA	V _{PORT} = 12.5 V	
Vcsr	_						

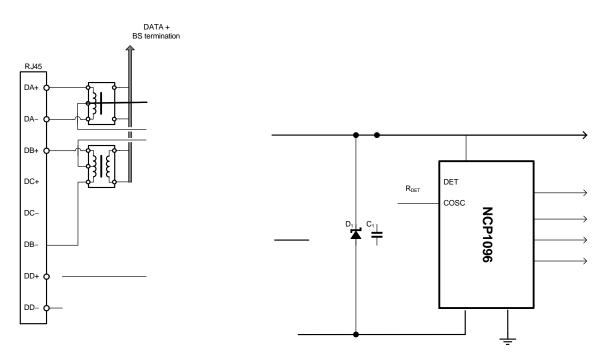
ELECTRICAL CHARACTERISTICS (continued) (All parameters are guaranteed for the recommended operating conditions unless otherwise noted)

Symbol Parameter Min Typ Max Unit Condition

RESET CHARACTERISTICS

Vrst

SIMPLIFIED APPLICATION SCHEMATIC





APPLICATION INFORMATION

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 μ F cap to 50 V. In combination with 3af/at PSEs the situation is different as it typically takes 75 ms to charge a 176 μ F 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 NCP1096 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

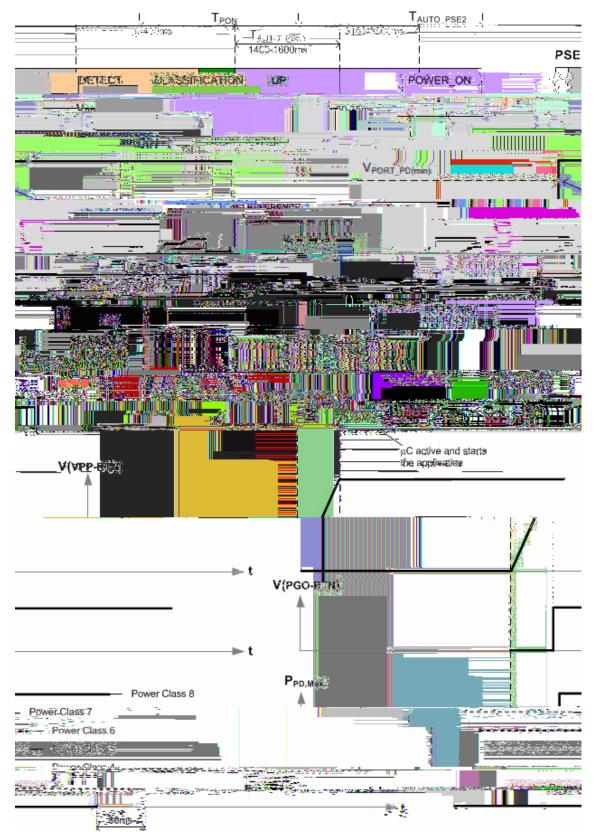


Figure 7. Complete Start-up Diagram of a Class 8 PD with Autoclass

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).

Table 5. SYSTEM PARAMETERS OVERVIEW

Assigned Class	PSE Type	Minimum Cabling Type

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

In general Cat 5 cabling 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.

Auxiliary Supply

To support applications connected to non-PoE enabled networks and to minimize the bill of materials, the NCP1096 supports drawing power from an alternate or local power source and allows a simplified design with auxiliary supply priority.

NCP1096 has a high voltage compliant AUX input pin. If the AUX pin voltage rises above the AUX_H threshold and remains high for a sufficient amount of time, the NCP1096 will turn off the pass switch and transition to the offline state (indicated by NCM, NCL and LCF being left floating). Disabling the pass switch based on the AUX input is useful for PD applications where the auxiliary supply has to be dominant over the PoE supply. When the auxiliary supply is inserted into a PoE powered application, the pass switch disconnection will move the current path from the PSE to the rear auxiliary supply. Since the current delivered from the PSE will go below the DC MPS level (as specified in the IEEE 802.3af/at, -3bt standard) the PSE will disconnect the PoE-PD. The auxiliary supply is connected between VPP and RTN with a serial diode D1 between VPP and VAUX+, as shown in Figure 8. It is recommended to use the circuit with PNP transistor in combination with an auxiliary supply.

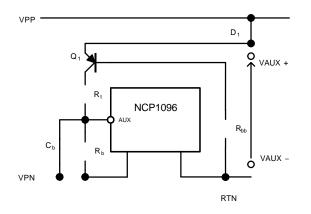


Figure 8. AUX Pin Interfacing

SIMPLIFIED APPLICATION SCHEMATIC WITH AUXILIARY SUPPLY

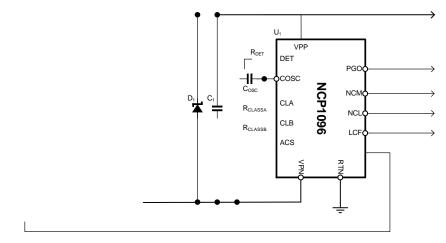
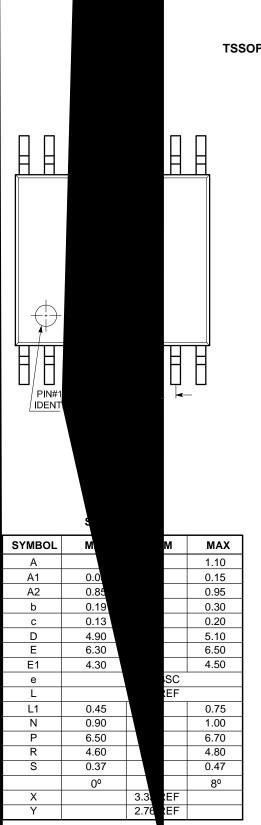


Figure 9. General Application Schematic with Auxiliary Supply



TSSOP16, 4.4x5 EXPOSED PAD CASE 948BV ISSUE O

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END VIEW

BOTTOM VIEW

Notes:

LAND PATTERN

- All dimensions are in millimeters. Angles in degrees.
 Complies with JEDEC MO-153 variations ABT.

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