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TND6315/D

IEEE 802.3bt PoE PD Reference Designs with an Isolated DC/DC Converter based on NCP1566

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REFERENCE DESIGN

General

This document describes how to make a Class 8 PD reference design by combining an IEEE 802.3bt PoE−PD EVB and an active clamp forward converter EVB based on NCP1566.

The PoE−PD EVB can be either NCP1095GEVB, based on PD Controller NCP1095 that uses an external pass−switch, or NCP1096GEVB, based on PD Controller NCP1096 with internal pass−switch.

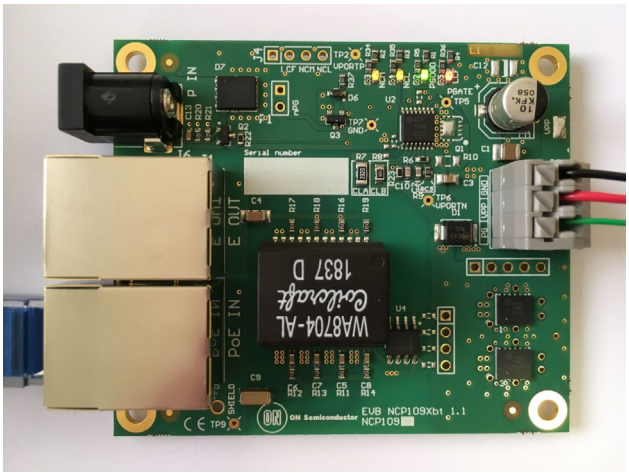

Figure 1. Operational PoE−PD EVB

The NCP1566 based DC/DC converter EVB can be either NCP1566POE12V6AGEVB, NCP1566TEL5V10AGEVB or NCP1566TELECGEVB (3.3 V/30 A).

Table 1. DC/DC CONVERTERS

DC/DC Converters	Output Voltage
NCP1566TELECGEVB	3.3 V
NCP1566TEL5V10AGEVB	5 V
NCP1566POE12V6AGEVB	12 V

Interconnection Schematic

The power output of the PoE−PD controller (net “GND” and net “VPORTP”) and the power input of the DC/DC converter (net “GND” and node “22”) need to be interconnected.

Next to these two power connections, there is a third control signal that is used to keep the DC/DC converter off when the PoE−PD controller is charging the input capacitance. Therefore, the control output of the PoE−PD controller (net “PGOOD”) and the control input of the DC/DC converter (node “40”) need to be connected to an additional diode, at the cathode and anode respectively.

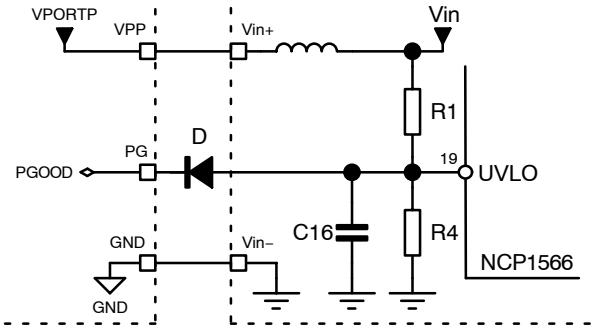

Figure 2. Top Level Schematic

Recommended part numbers for this diode (reference designator D in Figure 2) are BAS70L, NSR02100 or eventually BAS70SL.

Table 2. RECOMMENDED DIODES

Product	V_F Max (I_F = 1 mA)	I_R Max (V_R = 50 V)	Package Type
BAS70L	0.41 V	0.1 μA	SOT−23
NSR02100	0.45 V	0.05 μA	SOD−323
BAS70SL	0.41 V	0.2 μA	SOD−923

Guidance on how to fine−tune the schematics for the final design can be found in section ‘Maintain Power Signature (MPS)’ and eventually in sections ‘System Startup’ and ‘Auxiliary Supply’ further in this document.

Quick Interconnection and Start Guide

Step 1: Solder a wire on the undervoltage (UVLO) control connection of the NCP1566 DC/DC converter EVB: e.g. on the pad of capacitor C16 (highlighted by a rectangle in Figure 3 and at the end of the yellow wire in the Figure 4).

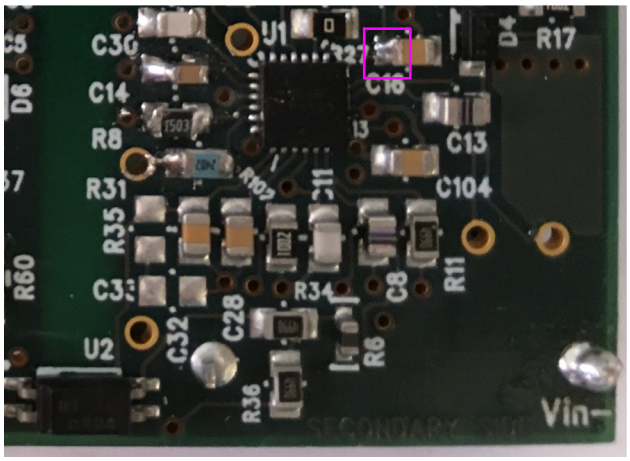

Figure 3. UVLO on NCP1566EVB

Step 2: Solder two wires on the power connections of the NCP1566 DC/DC converter EVB: e.g. on the pins of connector J1b and J1a (labeled “Vin−” and “Vin+”).

See the black and red wires in the picture below.

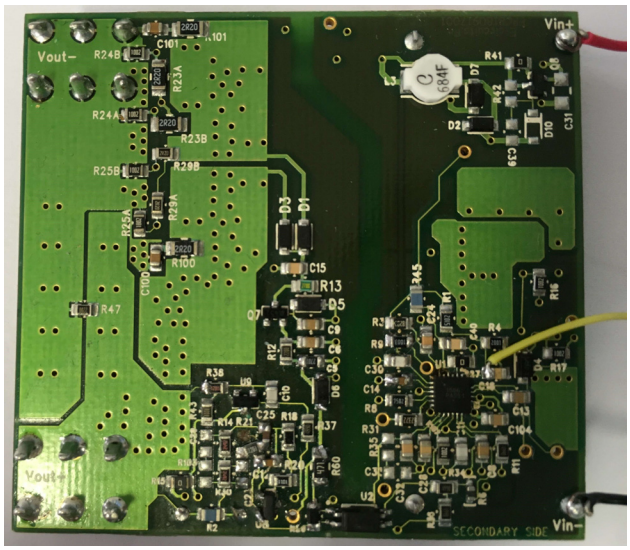

Figure 4. NCP1566EVB with Wire Connections

Step 3: Look for an additional diode. Recommended diode part numbers are listed in table 2, but a diode in Axial Lead (DO−35) package like BAY72, 1N3595, 1N914B or 1N4454 might be easier to work with here.

Solder the anode of this diode on the other end of the control connection wire already fixed to the NCP1566 DC/DC converter EVB before.

Connect the cathode of this diode to the control connection on connector J2 of the PoE−PD EVB (at the location labeled “PG”).

See the yellow wire and the DO−35 diode in the figure(s) below.

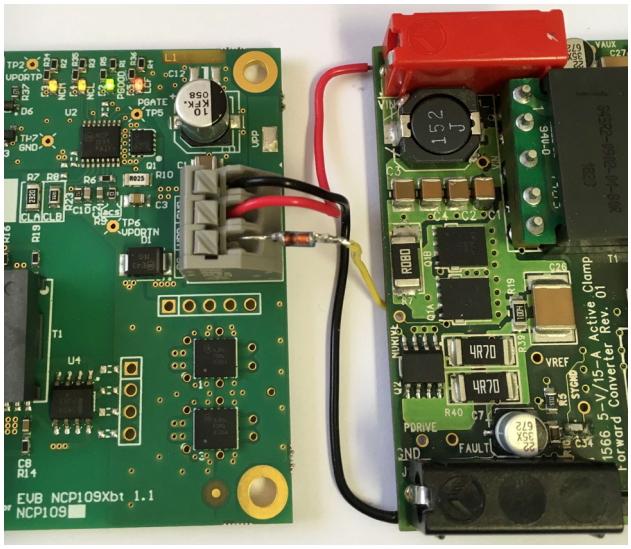

Figure 5. Interconnections between both EVBs

Step 4: Connect the power connections of the NCP1566 DC/DC converter EVB to connector J2 on the PoE−PD EVB (at the locations labeled “GND” and “VPP”).

See the black and red wires in the picture above.

Step 5: Insert the Ethernet cable (cf. blue cable in the picture below) coming from the PSE in the Ethernet connector J3 (labeled “PoE IN”) on the PoE−PD EVB.

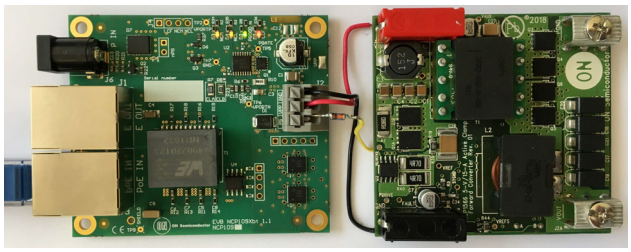

Figure 6. Operational PoE−PD and DC/DC EVBs Showing Basic Interconnections

If the PSE powers up the system the green PGOOD LED (located on the PoE−PD EVB) should be ON.

The status of the remaining LEDs depends on the PSE being used. See the NCP1095GEVB or NCP1096GEVB User’s Manual to determine the assigned power and the PSE categorization.

System Startup

A PD can be underpowered and assigned to Class 3 only. Therefore, the DC/DC converter behind the PoE−PD EVB should not draw more than 13 W during start−up.

Eventually – depending on the start−up behavior of the remainder of the system − the soft−start setting of the 5 V DC/DC converter (NCP1566TEL5V10AGEVB) might need to be adapted to accomplish this by increasing the capacitance value of C14.

Maintain Power Signature (MPS)

A PD should draw a minimum amount of current in order to prevent the PSE from removing power. The load resistor R15 was added on the bottom side of the PoE−PD eval board to make sure the load current is always sufficient and the PoE−PD EVB remains powered.

In combination with any of the three NCP1566 DC/DC converter EVBs this load resistor is no longer required. So for the final design, this load resistor should not be populated in order not to waste power unnecessarily.

Power Limit

The application should always operate at or below the assigned power limit. Failure to do so will result in the PSE disconnecting the PD!

PDs assigned to Class 8 may consume up to 71.3 W measured at the PD power interface. Therefore, the output current of the DC/DC converter should be limited to the values listed in Table 3:

Table 3. MAXIMUM ALLOWED DC/DC OUTPUT CURRENT FOR CLASS 8 OPERATION

DC/DC Converter EVB	Output Voltage	Output Current
NCP1566TELECGEVB	3.3 V	20 A
NCP1566TEL5V10AGEVB	5 V	13 Apk
NCP1566POE12V6AGEVB	12 V	5.4 A

Auxiliary Supply

The PoE−PD EVB supports drawing power from an alternate or local power source in applications connected to non−PoE enabled networks. A rear auxiliary supply can be inserted in connector J6 labeled “P IN”. However, the customer must take caution when using a high voltage auxiliary supply: the PoE−PD EVB has to be unpowered when this high voltage supply is inserted.

Do not insert the high voltage auxiliary supply when the PoE−PD EVB is already powered by a PSE.

Violating the warning above may result in the PD sourcing power on the “PoE IN” Ethernet connector.

The voltage of the auxiliary supply should be in the 48 V range as indicated in Table 4.

Table 4. ELECTRICAL CHARACTERISTICS

	Operating Range
Auxiliary Input Voltage **[Warning!]**	37.5–57 V
Auxiliary Input Current	0–2.4 A

If the customer needs to implement a system in which a high voltage rear auxiliary supply can be inserted while the PD is already powered by the PSE, the GreenBridge2 rectifiers need a gate drive circuit allowing them to be disabled. See the NCP1095GEVB or NCP1096GEVB User’s Manual or contact the GreenBridge2 application team.

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