NCP1096GEVB

NCP1096 Evaluation Board User's Manual

IEEE 802.3bt PoE-PD Interface Controller Board

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EVAL BOARD USER'S MANUAL

General

The NCP1096GEVB board allows easy implementation and evaluation of a Power-over-Ethernet powered equipment that is able to operate with an assigned power level up to 90 W. The evaluation board is based on the PoE PD Controller NCP1096 (U2) that uses an internal pass-switch and sense resistor. The board can also facilitate the design of proprietary 100 W+ applications.

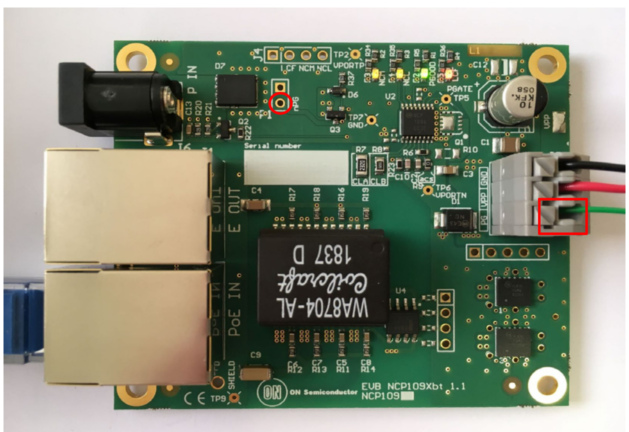

Figure 1. Operational NCP1096GEVB Showing Basic Interconnections

The NCP1096GEVB board is designed as a PoE splitter: having a PoE-enabled Ethernet port (labeled "PoE IN") as input and offering the power to a separate connector (J2) while passing through the data to another Ethernet port (labeled "E OUT").

Quick Start Guide

Step 1: Connect the power connections available on connector J2 (labeled "GND" and "VPP") to the DC/DC converter on the system that needs to be powered (cf. black and red wires in the picture on the left). The DC/DC converter behind the NCP1096 EVB should be operational over a 34 V to 57 V voltage range.

Step 2: Connect the **control connection** to the DC/DC converter! **It is important that the DC/DC converter or any significant load is kept off when the pass-switch is charging the input capacitance.**

For a DC−DC converter with an undervoltage (UV or UVLO) or an active high enable (EN or $\overline{\text{SHND}}$), the "**PG**" signal on connector J2 could be used (cf. green wire in the picture on the left). The "PG" signal will be clamped to 18 V by a zener when the board is powered up. For some DC−DC converter boards an additional diode in series with the control connection might be required (cathode connected to NCP1096 and anode connected to the DC−DC converter).

For a DC−DC converter with an active low enable ($\overline{\text{EN}}$ or SHDN or $\overline{\text{ON}}$/OFF), the "nPG" signal on P1 could be used. The "**nPG**" signal will be pulled up to VPP during the inrush phase. Always check the voltage rating of the enable, shutdown or undervoltage pin of the DC−DC converter.

Step 3: Insert the Ethernet cable (cf. blue cable in the picture on the left) coming from the PSE in the Ethernet connector J3 labeled "PoE IN".

If the PSE powers up the system the green PGOOD LED should be ON.

The status of the remaining LEDs depends on the PSE being used.

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Assigned Power

The NCP1096GEVB will request Class 8 during Physical Layer classification. PDs need to take into account that they can be underpowered and eventually be assigned to Class 3, 4 or 6.

The state of the NCM and NCL outputs provides information about the power level that the PSE has assigned to the NCP1096GEVB during classification. See Table 1 to determine the assigned power based on the status of the orange NCM and NCL leds.

Table 1. CLASSIFICATION RESULT

NCM Led	NCL Led	Assigned Class	Assigned Power
off	off	3	13 W
off	on	4	25.5 W
on	off	6	51 W
on	on	8	71.3...90 W

PDs assigned to Class 8 may consume greater than 71.3 W as long as they guarantee not to exceed the 90 W power limit at the PSE power interface. Operation beyond 71.3 W is, however, only possible if additional information is available to the PD regarding the actual link section DC resistance between the PSE and the PD.

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

PSE Categorization

The state of the LCF output provides information (retrieved during classification) about the type of PSE the NCP1096GEVB is connected to. See Table 2 to determine the PSE Type based on the status of the red LCF led.

Table 2. PSE TYPE

LCF Led	PSE Categorization
off	The PSE is categorized according to 802.3af/at (PSE Type 1 or Type 2)
on	The PSE is categorized according to 802.3bt (PSE Type 3 or Type 4)

The PSE Type determines the MPS timing. It also indicates to a PD requesting Autoclass whether it makes sense to go to the maximum power state according to its assigned Class.

System Startup

A PD can be underpowered and assigned to Class 3 only.

Therefore the DC/DC converter behind NCP1096GEVB should not draw more than 13 W during start-up. Eventually the soft-start setting of the DC/DC converter might need to be adapted to accomplish this.

Requested Power

As mentioned before, the NCP1096GEVB will request Class 8 during Physical Layer classification. If a lower Class or power level is preferred, resistor R8 labeled “CLB” and/or resistor R7 labeled “CLA” should be changed. See the NCP1096 datasheet for the nominal resistance values.

The Class the PD is actually assigned to is always limited to the requested Class.

Autoclass

The NCP1096GEVB will by default not request Autoclass during Physical Layer classification. If the PD should request Autoclass, remove 0E resistor R9 labeled “acs”.

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 board to make sure the load current is always sufficient and the NCP1096GEVB remains powered.

Depending on the minimum current the system may draw, the resistance value of R15 should be increased for the final design in order not to waste power unnecessarily.

For some systems, the load resistor can even be omitted.

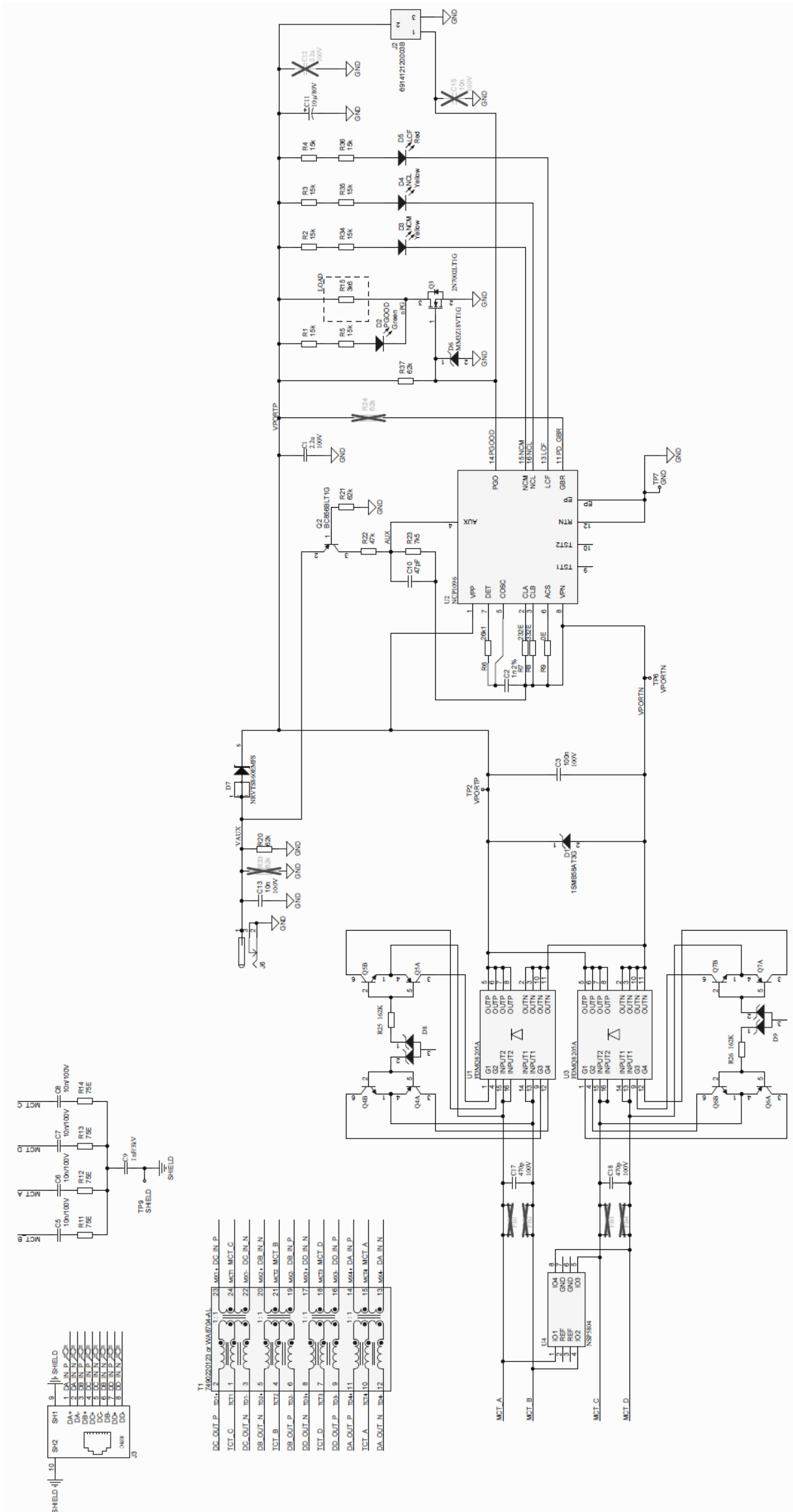

Figure 2. Schematic Diagram NCP1096

Auxiliary Supply

The NCP1096GEVB 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”.

The recommended voltage of the auxiliary supply is 24 V.

Table 3. ELECTRICAL CHARACTERISTICS

	Operating Range
Auxiliary Input Voltage	20–30 V
Auxiliary Input Current	0–5 A
Auxiliary Input Voltage, Extended **[Warning!]**	10–57 V

If an auxiliary supply that is too low (10.1 V… 20 V) is inserted before the UVLO threshold was crossed by the PSE, the class driver could become unintentionally activated. Therefore it is recommended to adapt the AUX resistor divider to R_{22} = 33 kΩ and R_{23} = 15 kΩ for operation with a low voltage auxiliary supply voltage.

The NCP1096GEVB is able to operate with an auxiliary supply voltage up to 57 V. However the customer must take caution when using a high voltage (>30 V) auxiliary supply: the NCP1096GEVB has to be unpowered when this high voltage (30 V… 57 V) supply is inserted.

Do not insert a high voltage (>30 V) auxiliary supply when the NCP1096GEVB is already powered by a PSE.

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

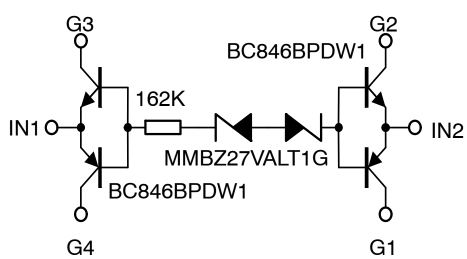

Figure 3. GreenBridge2 GDC on NCP1096GEVB

If the customer needs to implement a system in which a high voltage (>30 V) rear auxiliary supply can be inserted while the PD is already powered by the PSE, both GreenBridge2 rectifiers (U1 and U3) need a gate drive circuit allowing them to be disabled. Figure 4 shows a gate drive circuit (GDC) able to turn off the GreenBridge2 internal top MOSFETs.

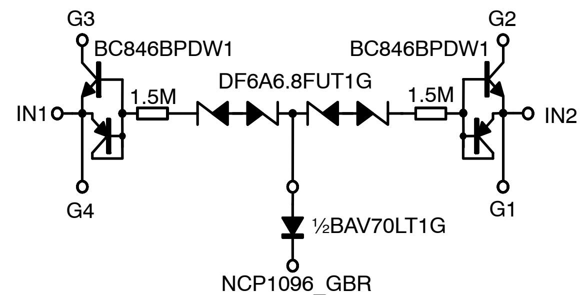

Figure 4. Basic GreenBridge2 GDC with Disable

If the AUX input pin of NCP1096 is pulled high, it will immediately drive the GBR pin low. The above gate drive circuit controlled by the GBR pin makes sure the PD does not source power under any circumstance in combination with a high voltage (> 30 V) auxiliary supply.

The gate drive circuit shown in Figure 4 is NOT implemented on NCP1096GEVB. Therefore a high voltage (>30 V) auxiliary supply should not be inserted when NCP1096GEVB is already powered by a PSE.

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