

NCN26010 / NCN26000 Frequently Asked Questions

This document is a collection of frequently asked question centered around the use of 10BASE-T1S single pair ethernet products

Q: The 802.3cg standard talks about 25m reach, how long of a reach is supported by onsemi's 10BASE-T1S PHY and MACPHY devices?

A: The IEEE802.3cg standard has wording that tries to express that a minimum of 25m reach needs to be supported when respecting the insertion loss and return loss parameters expressed in the standard. There is also a note in the standard expressing that longer reach can be supported by different implementations.

onsemi's NCN26000 and NCN26010 devices have been demonstrating to reach >50m in a setup with eight station. There are numerous parameters that can affect reach. These are:

- Noise levels
- Quality of the cable
- Connectors being used
- Termination

While we cannot give guarantees we feel confident that 50m of reach can be achieved using quality cables and careful PCB layout.

Q: The 802.3cg standard talks about up to eight. Do onsemi's 10BASE-T1S PHY and MACPHY devices support more stations on a single cable?

A: onsemi has showed forty stations on a 25m segment. The total number of stations depend on a lot of parameters like noise, cable quality, type of connectors, node capacitance. Onsemi's NCN260x0 devices have the lowest differential capacity on towards the MDI or 5.5pF typical, while the IEEE allows for 15pf. While there is no guarantee on the maximum number of nodes a number >16 should be achievable in most cases.

Q: 802.3cg defines two different PHY standards, 10BASE-T1L and 10BASE-T1S. Are onsemi's NCN260x0 10BASE-T1S devices interoperable with 10BASE-T1L?

A: No. NCN260x0 devices are half-duplex, short range, multi-drop, single pair ethernet devices, while the 10BASE-T1L physical layer defines a point-to-point long reach (up to 1km) segment. Line coding and signal levels differ between the two technologies. 10BASE-T1L uses PAM3 encoding at up to 2.5Vpp while 10BASE-T1S is differential Manchester coding with 1Vpp signal levels. The two PHY standards are incompatible, in a sense that you cannot mix and match 10BASE-T1S and 10BASE-T1S on a single cable.



Q: PLCA needs unique PLCA IDs for all PHY devices sharing the same multi-drop segment (= cable). How are the PLCA IDs assigned?

A: every PHY on a multi-drop segment needs to have its own ID and it needs to be locally configured. The ID=0 denotes the coordinator that sends out the BEACON. There is not standard way of assigning the IDs remotely defined in 802.3cg. It is the system integrator's responsibility to assign these ID, should the system run PLCA on the multi-drop segment. There are different ideas on how to propagate IDs, which typically requires higher level protocols (above L2) and starting the links in CSMA/CD. one of such ideas is to initiate the PCLA ID assignment starting with the coordinator. As the coordinator creates its own beacon it can fully run in PLCA even when the other nodes on the segment run in CSMA/CD. A broadcast ping request could then tell the coordinator the MAC addresses of all stations on the segment. Once that station has gathered all MAC addresses it can then assign consecutive PLCA IDs using a dedicated L2 ethernet frame or a TCP/IP or UDP message. If a station receives that frame, it can set its PLCA ID and switch to PLCA mode. The implementation of such protocol lies in the responsibility of the user of the 10BASE-T1S devices.

Q: In a PLCA enabled network segment, what happens if the coordinator node stops working.

A: Should the coordinator in a PLCA enable segment stop to send beacons, all stations will fall back to CSMA/CD. The NCN260x0 devices can signal the change in PLCA status to their host. It is up to the host to decide what to do in that case. Onsemi's NCN260x0 support a non-standard feature that allows any node ID to become a coordinator. This has been assessed with third party devices and proven to work. In case of the ID 0 coordinator not sending the BEACON, software on a host could decide for example to assign ID 1 the coordinator role, if it is notified of a change in PLCA status by NCN260x0. Should that station also fail to send beacons, the next higher ID could take over the coordinator role. It is in the sole responsibility of the user of the device to design software routines that coordinate the change in coordinator roles.

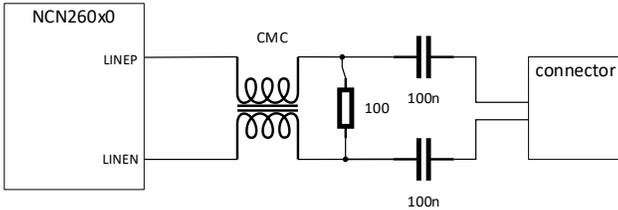
Q: Does Enhanced Noise Immunity break the IEEE standard or in other words, is ENI interoperable with third party 10BASE-T1S devices?

A: Yes! Onsemi's NCN260x0 10BASE-T1S devices feature an enhanced noise immunity function that changes the way the transceivers receive and decode the incoming data packets. While it is on the RX side, the transmit part of the receiver remains unchanged and generates signal 100% in line with the IEEE802.3 specifications. While in PLCA, there is no side effect when using ENI. In CSMA/CD there is a slight reduction in the ability of detecting collisions. We expect most of the 10BASE-T1S links to run in PLCA. When in doubt and running in CSMA/CD, we recommend that users not use ENI. However, that may have a negative impact on reach, number of nodes and tolerance to noise on the line. When not in ENI mode onsemi's NCN260x0 perform at least as good as competitor devices. When all devices on the segment are onsemi 10BASE-T1S devices running ENI and PLCA, you gain the maximum benefit on ENI. In addition to ENI there is Collision masking that can only be enabled when in PLCA. Enabling both ENI and Collision Detection Masking gives the highest level of noise tolerance and increase the change to get to reach beyond 50m.



Q: how do I best do line termination?

A: onsemi recommends doing line termination following the schematic below. We strongly recommend the use of common mode chokes.

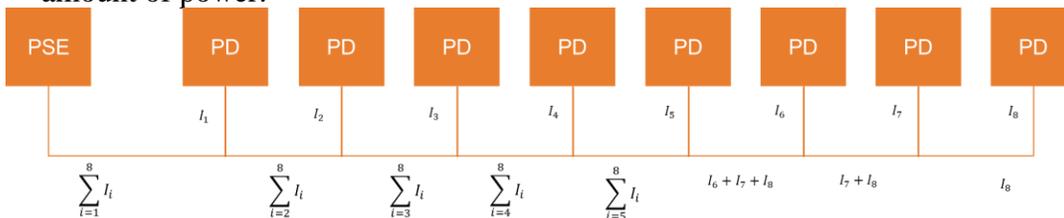


Note that the 100 Ω termination resistor shall only be connected to end nodes (both ends of the cable).

As shown, pulling the termination resistor behind the DC blocking capacitors will prevent the resistor from dissipating power in case of the cable also transporting DC power. This allows the use of engineered power over data line (see next question).

Q: what about PoDL?

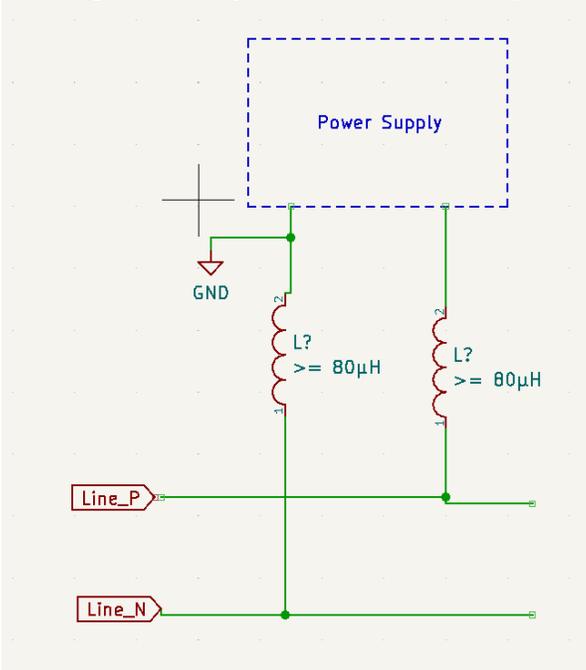
A: While the IEEE 802.3cg does not define PoDL for multi drop segments, it is possible to transport DC power along with the Ethernet data over the same cable. We refer to this as “engineered PoDL” because there is no mechanism existing that help with negotiation power requirements among the DC Power sourcing equipment (PSE) and the individual powered devices (PD) on a multidrop segment. It is in the responsibly of the implementer to make sure the cable as well as the PSE do not get overloaded. Following picture illustrates the currents on parts of the multidrop segment under the assumption that all stations consume the same amount of power:



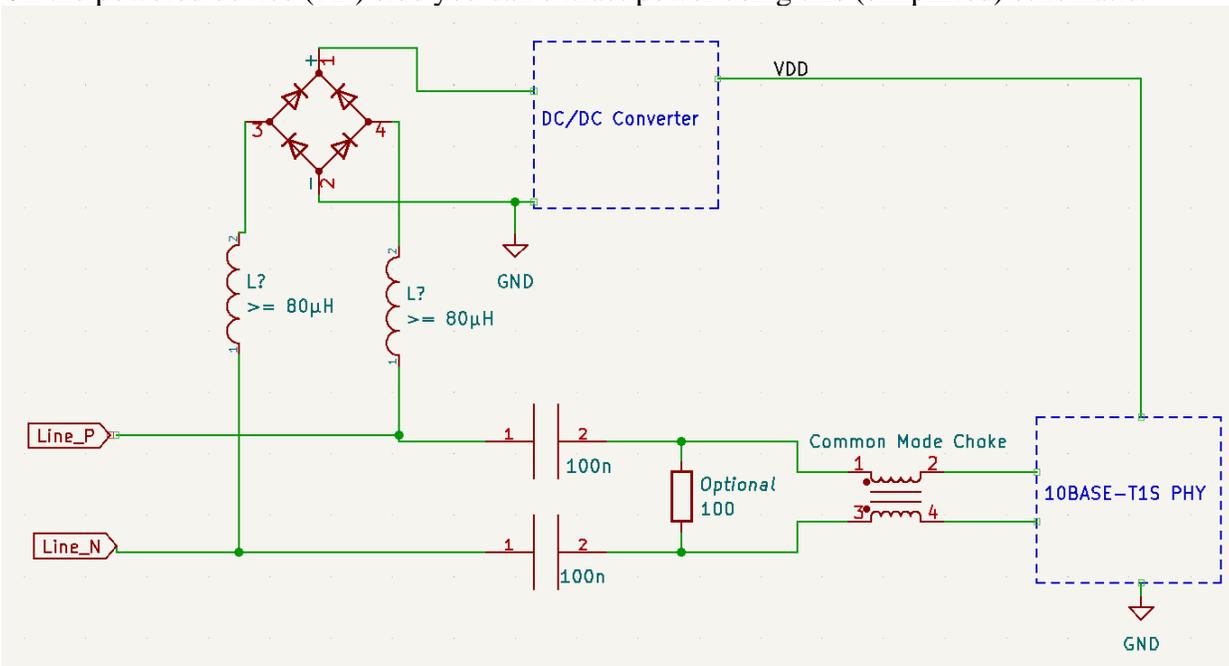
Note that DC Voltage on the cable can be up to 60V.

Q: O.K. but how do I inject, extract power from the PoDL twisted pair data line?

A: DC power is injected into the cable by use of $>80\mu\text{H}$ inductors or a $100\mu\text{H}$ differential mode choke like this:



On the powered device (PD) side you can extract power using this (simplified) schematic:



Note that bridge rectifiers have a forward voltage of up to 1V which has an impact on efficiency. Assume a 200mA at 24V input, the rectifier would “burn” 200mW or approx. 4.2%.

We recommend the use of onsemi’s [FDMQ8205](#) “GreenBridge” MOSFET rectifier to increase efficiency.

Under the same conditions, the GreenBridge would dissipate between 2mW and 9mW of power.

Q: does onsemi supply Linux drivers?

A: starting with kernel 6.3, Linux natively supports NCN26000. All you must do is compile the appropriate kernel module.

NCN26010 drivers are currently being developed and should appear in the Linux kernel soon.

