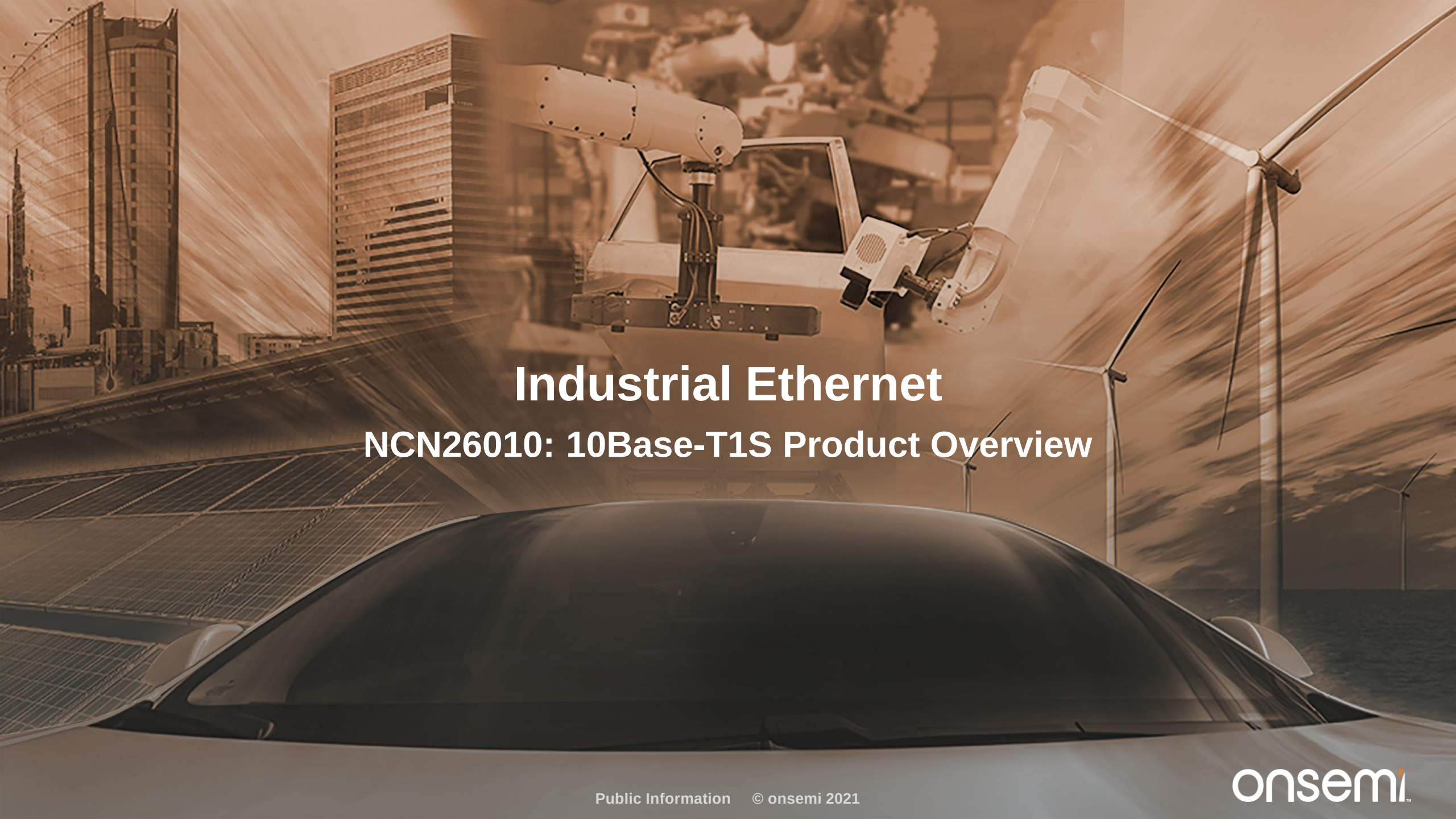
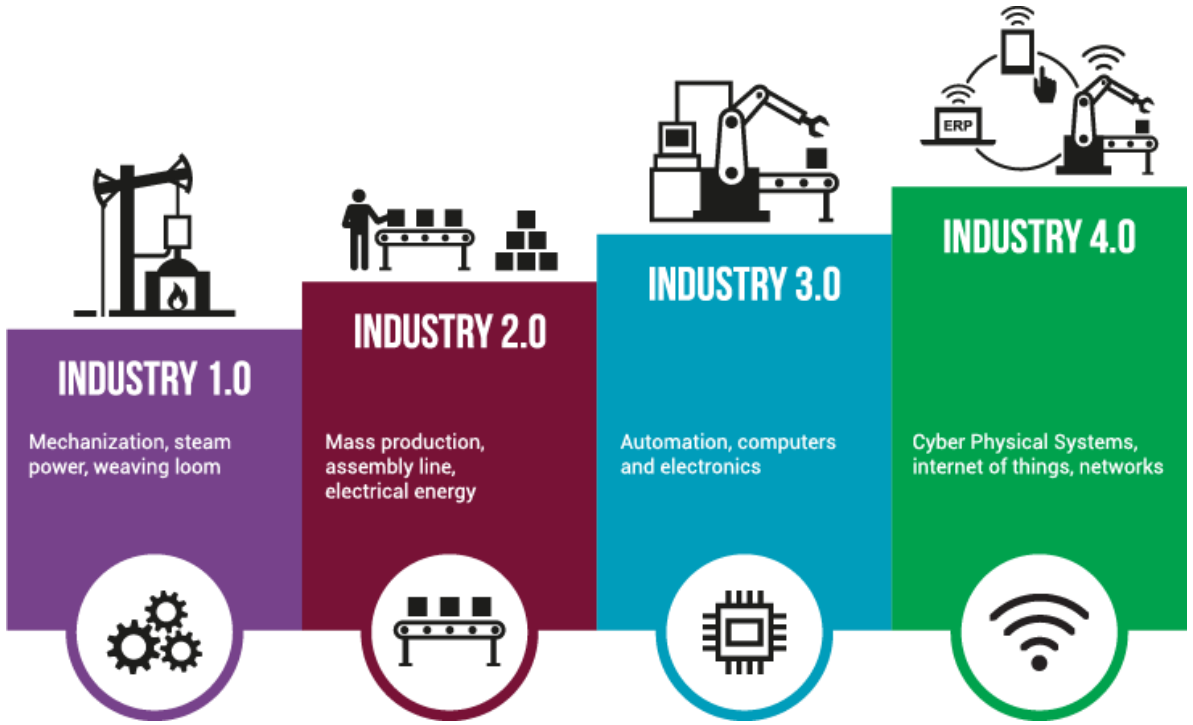


Industrial Ethernet

NCN26010: 10Base-T1S Product Overview

Industry 4.0 Revolution and Market Trend



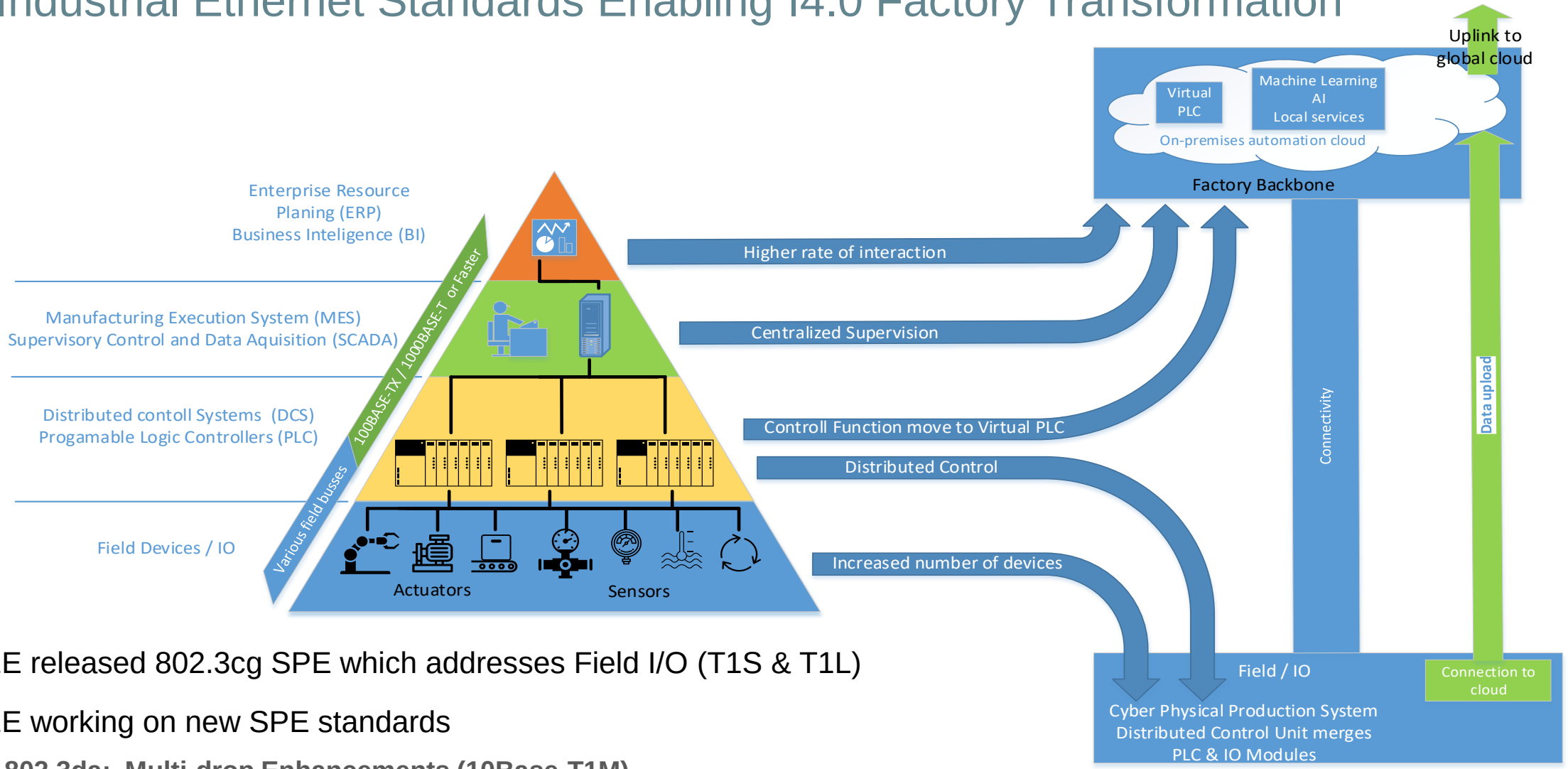
Significant growth of semiconductor demand in industrial market to support higher connectivity, sensing, and computation to the edge

Industrial Ethernet and 802.3cg

10Base-T1S

Top-to-Bottom Single-Pair Ethernet (SPE)

New Industrial Ethernet Standards Enabling I4.0 Factory Transformation



- IEEE released 802.3cg SPE which addresses Field I/O (T1S & T1L)
- IEEE working on new SPE standards
  - **802.3da: Multi-drop Enhancements (10Base-T1M)**
  - **802.3dg: 100Mb, 500m Point-to-Point SPE**

IEEE 802.3cg Multidrop Highlights

Standard approved Q4 2019

Targeting Industrial, Automotive, Building and Intra-System 10Mb/s Networking

- 10Base-T1S: Short Reach (15 meters point-to-point / 25 meters multi-drop)
- Optional full duplex point-to-point, half duplex multi-drop

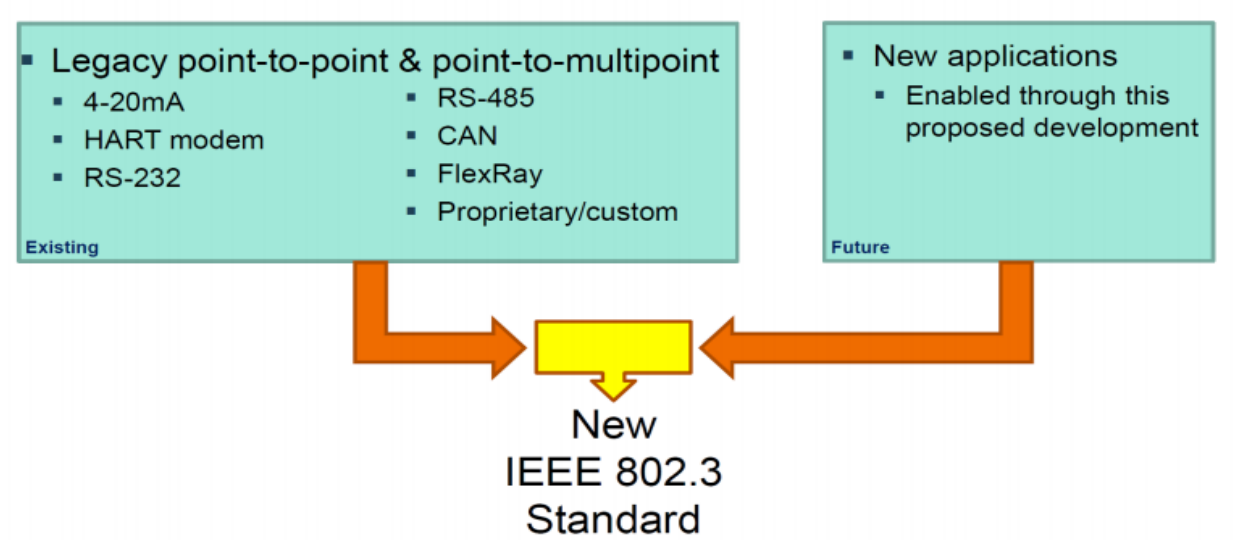
1 Reconciliation Sublayer

- PHY-Level Collision Avoidance (PLCA) for enhanced multi-drop performance
- Improves performance (over traditional CSMA-CD of “plain” Ethernet) in high loading situations
- If network set up properly, collisions are avoided due to “round robin” approach

Preserves the IEEE 802.3/Ethernet frame format at MAC interface

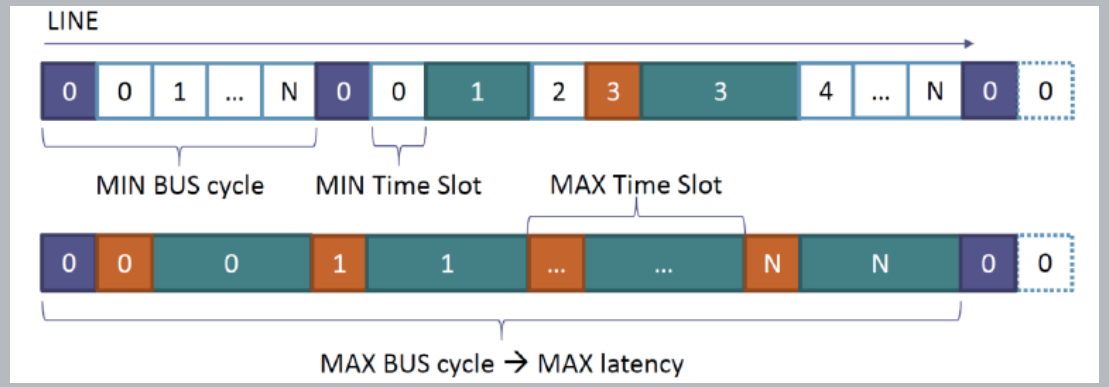
- Layers above MAC sublayer are unchanged
- Developers can still use existing software/IP in higher layers
- From a semiconductor point-of-view only the PHY and MAC are different

Why 802.3cg? Unify Communications and Improve Throughput

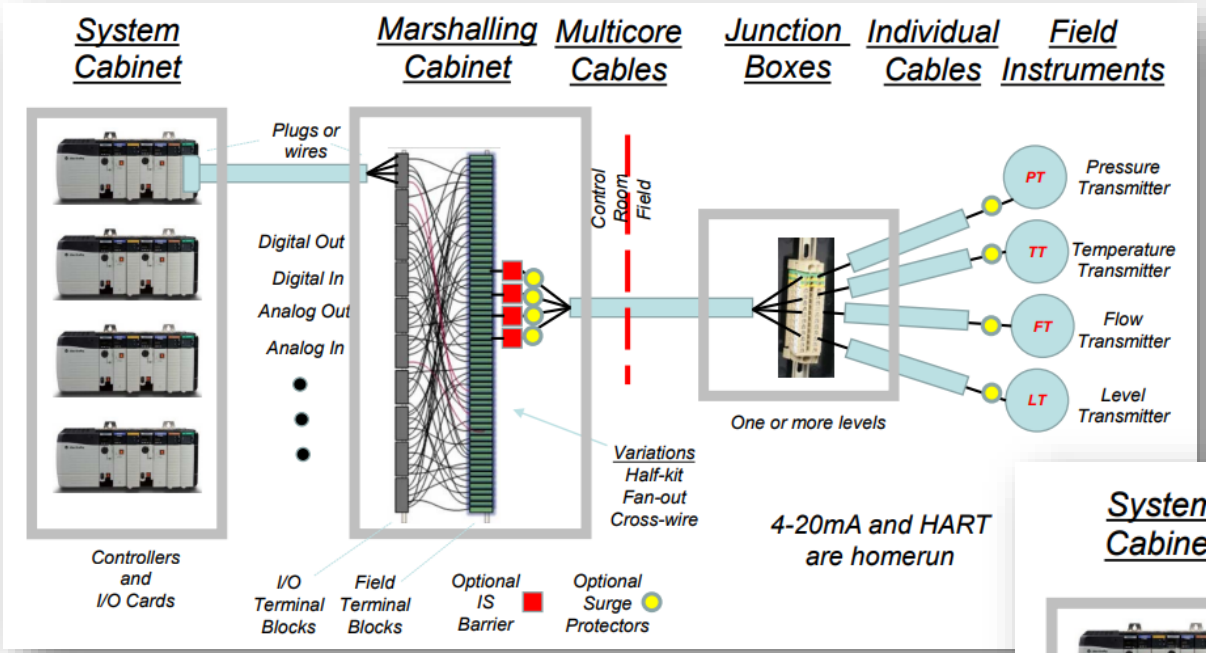


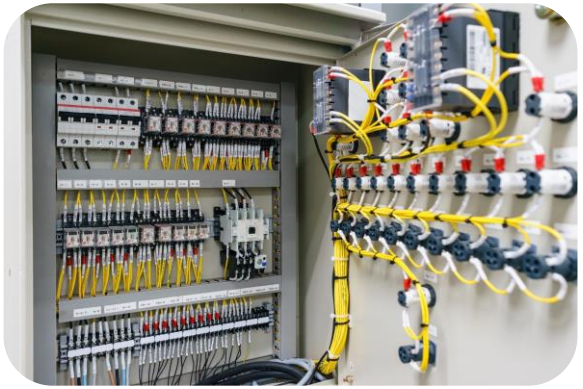
- Consolidate many point-to-point communication standards into one
- Existing networks at the edge use a mix of protocols
  - HART, RS-232, RS-485, CAN, FlexRay, Proprietary / Custom, etc.
- Installing and maintaining multiple edge protocols is difficult and expensive

- **802.3cg PLCA uses "round robin" arbitration for nodes to transmit**
  - Each PHY assigned ID
- **Increases throughput at high utilization (no collisions)**

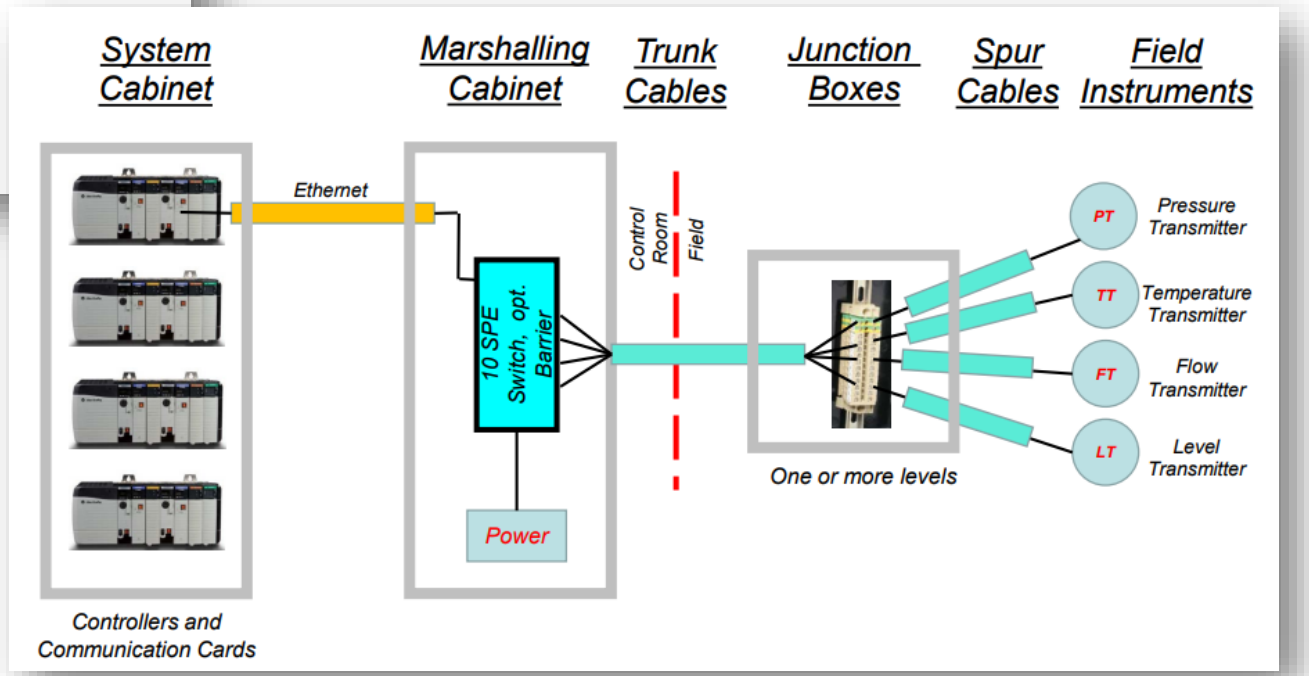


Why 10Base-T1S? Multi-Drop and Wire Reduction





One twisted-pair replaces all yellow control wires used today. Can implement Ethernet with *existing* wires.



Multi-drop requires far fewer wires, reducing overall BOM and servicing costs.

40 nodes on 25-meter Single-Pair Ethernet (SPE) network demonstrated with onsemi's T1S PHY.

Source: www.ieee802.org/3/10SPE/public/Nov2016/diminico_01b_1116.pdf

Example Applications for 10Base-T1S

In-Cabinet Wiring

- Industrial cabinets run a large quantity and volume of wire and generally run at lower bandwidths.
- T1S Ethernet increases bandwidth while dramatically reducing the number and volume of wires.
- The simple wiring scheme for T1S also greatly reduces the time and cost of the wire installation.

Backplanes

- The multidrop of T1S Ethernet drastically simplifies backplanes layout and power distribution
- T1S maintains high data rates and low-latencies

Sensors

- T1S Ethernet is ideal for handling small networks of sensors (e.g., smart streetlight)
- T1S can manage both data communication and power over data lines.

Intra-System Communications

- T1S Ethernet can replace most of I2C, SPI, and other proprietary on-board busses found on PCBs (e.g. server motherboards).
- Reduces software and maintenance efforts significantly.

NCN26000/10

10Base-T1S Products

NCN26010: 10Base-T1S Industrial Ethernet

Value Proposition

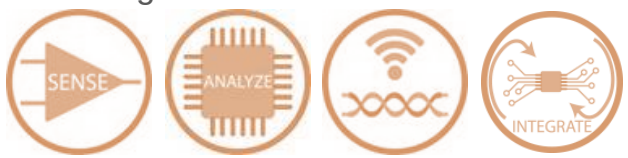
Provide multi-drop Ethernet communication for industrial applications using existing twisted-pair wire infrastructure.

Unique Features & Benefits

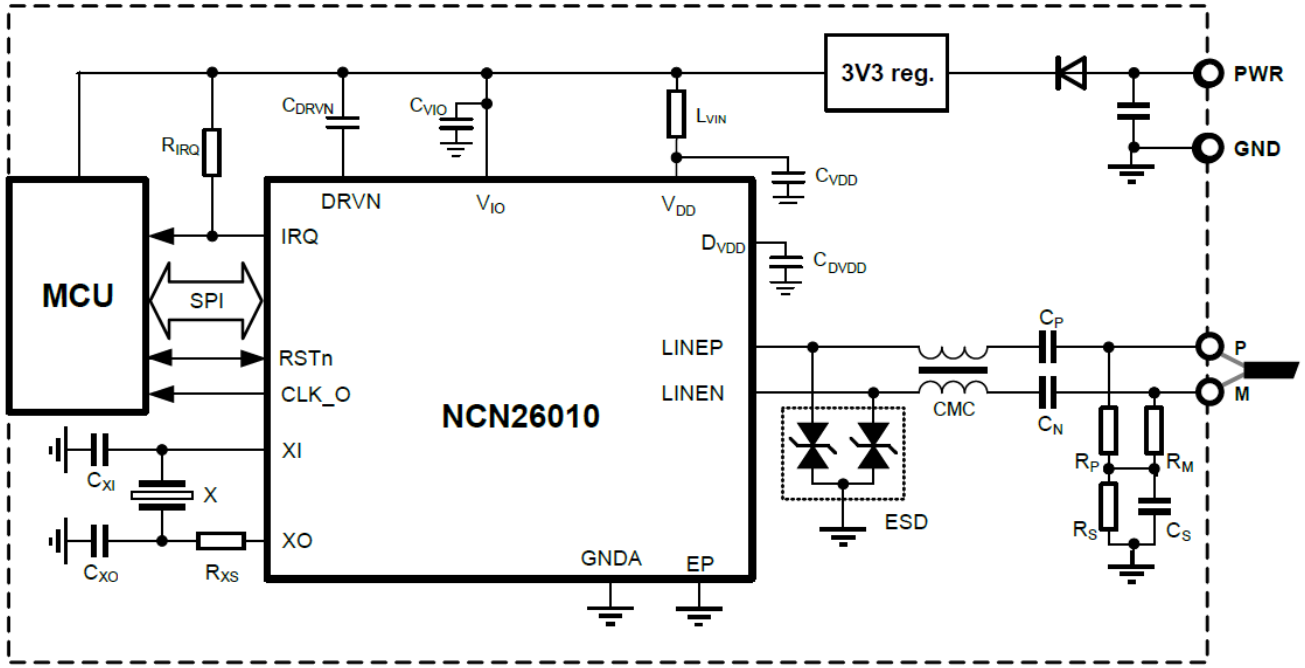
- IEEE 802.3cg 10Base-T1S Compliant
- OPEN Alliance MAC-PHY Compliant (TC14 specs)
- Data rate of 10Mbit/s Half Duplex
- MAC-PHY Controller with SPI
- Physical Layer Collision Avoidance (PLCA)
- Enhanced Noise Immunity
- Replace various wired protocols: HART, FieldBus, CAN, RS485, RS232, FlexRay, etc.
- 32-pin QFN, 4mm x 4mm (Available today)
- 32-pin TQFP, 5mm x 5mm body size (Q4'22 release)

Markets & Applications

- Process and Factory Automation
- Industrial wired connectivity
- Contactors/Overload Protectors
- Valves/Actuators
- Data Center Management



Application Diagram



NCN26010 Additional Features

Enhanced Noise Immunity

Allows extending the PHY noise immunity to levels above 500mVpp, allowing the device to withstand a worst-case DPI and BCI immunity test.

Does not break compatibility but only shows improvement on onsemi devices

PLCA Precedence Mode

Lower PLCA ID gets precedence over higher ones (similar to CAN arbitration)

Collision Detection Masking

(in PLCA mode)

PLCA Leader Mode

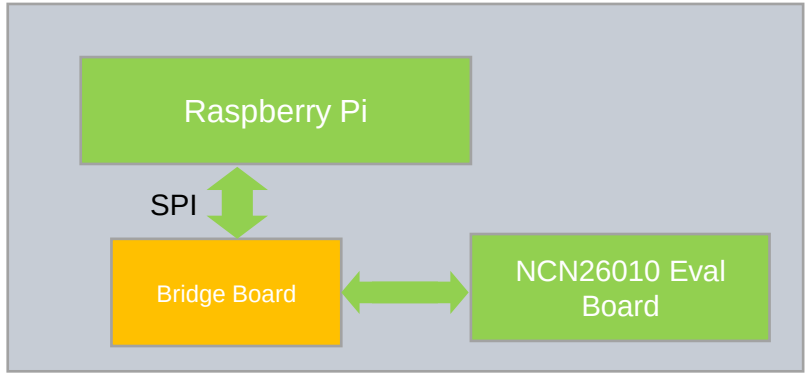
Stations with ID other than 0 may start the PLCA cycle

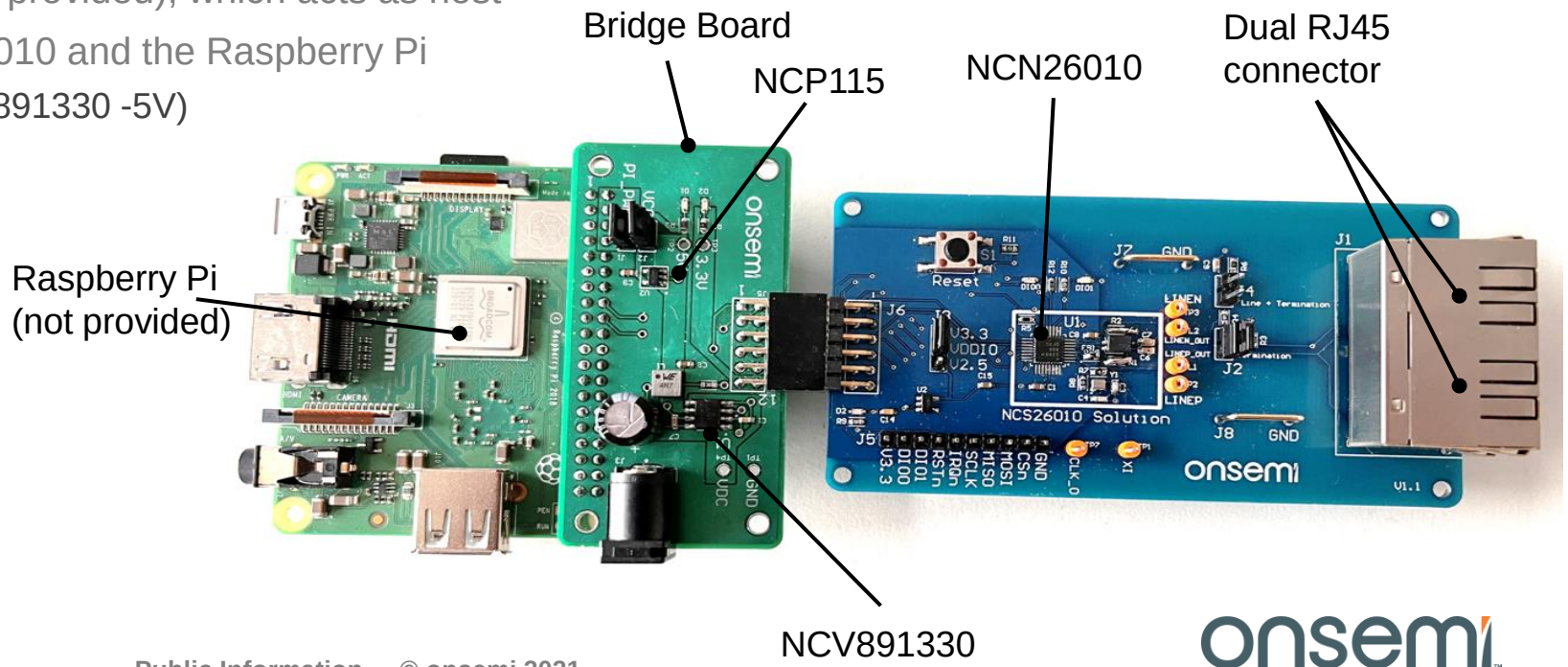
Unique Programmed MAC Address

Four MAC Address Filters

NCN26010 Evaluation Kit

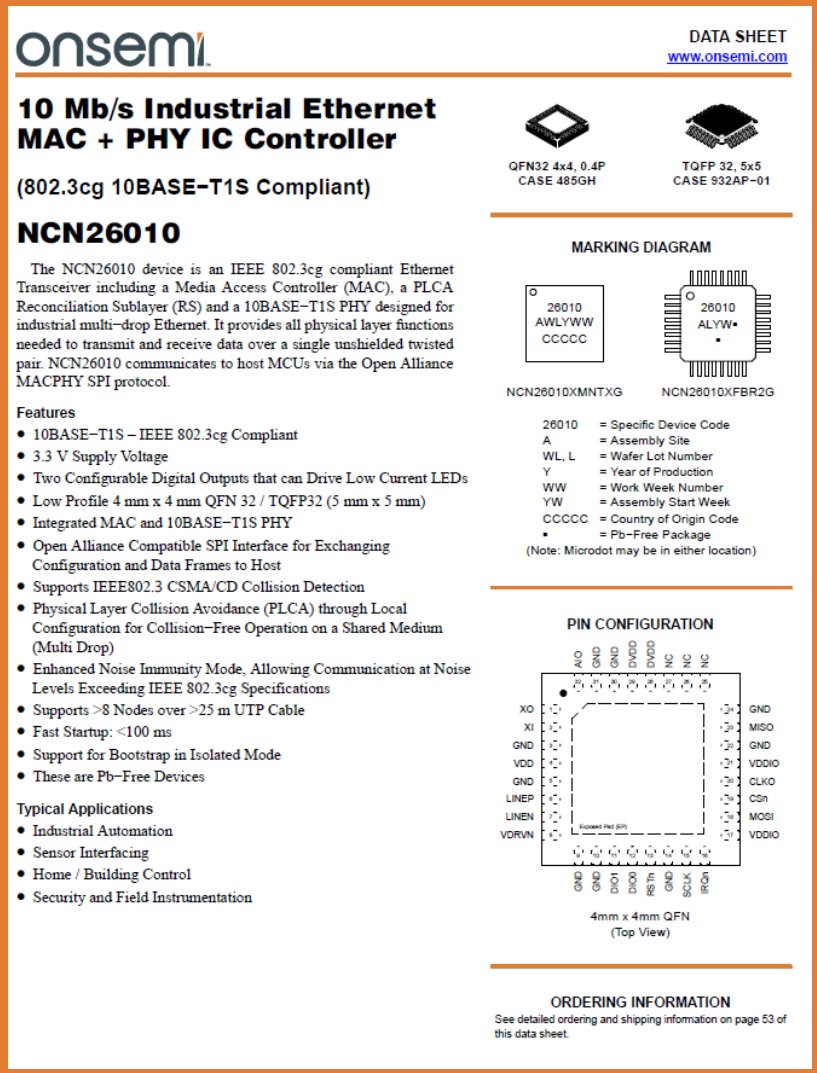
- NCN26010XMNEVB Eval Board
  - Standard PMOD connector (to host MCU)
  - Dual RJ45 connector
    - Allows use of readily available Cat 3/5e cables but only uses one twisted pair
- NCN26010BMNEVB Bridge Board
  - Connects to a Raspberry Pi (not provided), which acts as host
  - Provides power for both NCN26010 and the Raspberry Pi
    - DC-DC buck regulator (NCV891330 -5V)
    - 3.3V LDO (NCP115)





NCN26010 Collateral

- Datasheet
- Getting Started Application Note
- Evaluation Kit
  - NCN26010 EVB & Bridge Board
- EVK and EVB User Guides
- IBIS Model
- Raspberry Pi/Linux User Space App
- Firmware Example Code
  - FreeRTOS and RSL-10
  - Bare metal lwIP for STM32 (echo server)
- Software/Firmware User Guide



onsemi

DATA SHEET
www.onsemi.com

10 Mb/s Industrial Ethernet MAC + PHY IC Controller

(802.3cg 10BASE−T1S Compliant)

NCN26010

The NCN26010 device is an IEEE 802.3cg compliant Ethernet Transceiver including a Media Access Controller (MAC), a PLCA Reconciliation Sublayer (RS) and a 10BASE−T1S PHY designed for industrial multi−drop Ethernet. It provides all physical layer functions needed to transmit and receive data over a single unshielded twisted pair. NCN26010 communicates to host MCUs via the Open Alliance MACPHY SPI protocol.

Features
- 10BASE−T1S – IEEE 802.3cg Compliant
- 3.3 V Supply Voltage
- Two Configurable Digital Outputs that can Drive Low Current LEDs
- Low Profile 4 mm x 4 mm QFN 32 / TQFP32 (5 mm x 5 mm)
- Integrated MAC and 10BASE−T1S PHY
- Open Alliance Compatible SPI Interface for Exchanging Configuration and Data Frames to Host
- Supports IEEE802.3 CSMA/CD Collision Detection
- Physical Layer Collision Avoidance (PLCA) through Local Configuration for Collision−Free Operation on a Shared Medium (Multi Drop)
- Enhanced Noise Immunity Mode, Allowing Communication at Noise Levels Exceeding IEEE 802.3cg Specifications
- Supports >8 Nodes over >25 m UTP Cable
- Fast Startup: <100 ms
- Support for Bootstrap in Isolated Mode
- These are Pb−Free Devices

Typical Applications
- Industrial Automation
- Sensor Interfacing
- Home / Building Control
- Security and Field Instrumentation

QFN32 4x4, 0.4P
CASE 485GH

TQFP 32, 5x5
CASE 932AP−01

MARKING DIAGRAM

26010
AWLYWW
CCCCC

NCN26010XMNTXG

26010
ALYW▪
▪

NCN26010XFBR2G

26010	= Specific Device Code
A	= Assembly Site
WL, L	= Wafer Lot Number
Y	= Year of Production
WW	= Work Week Number
YW	= Assembly Start Week
CCCCC	= Country of Origin Code
▪	= Pb−Free Package

(Note: Microdot may be in either location)

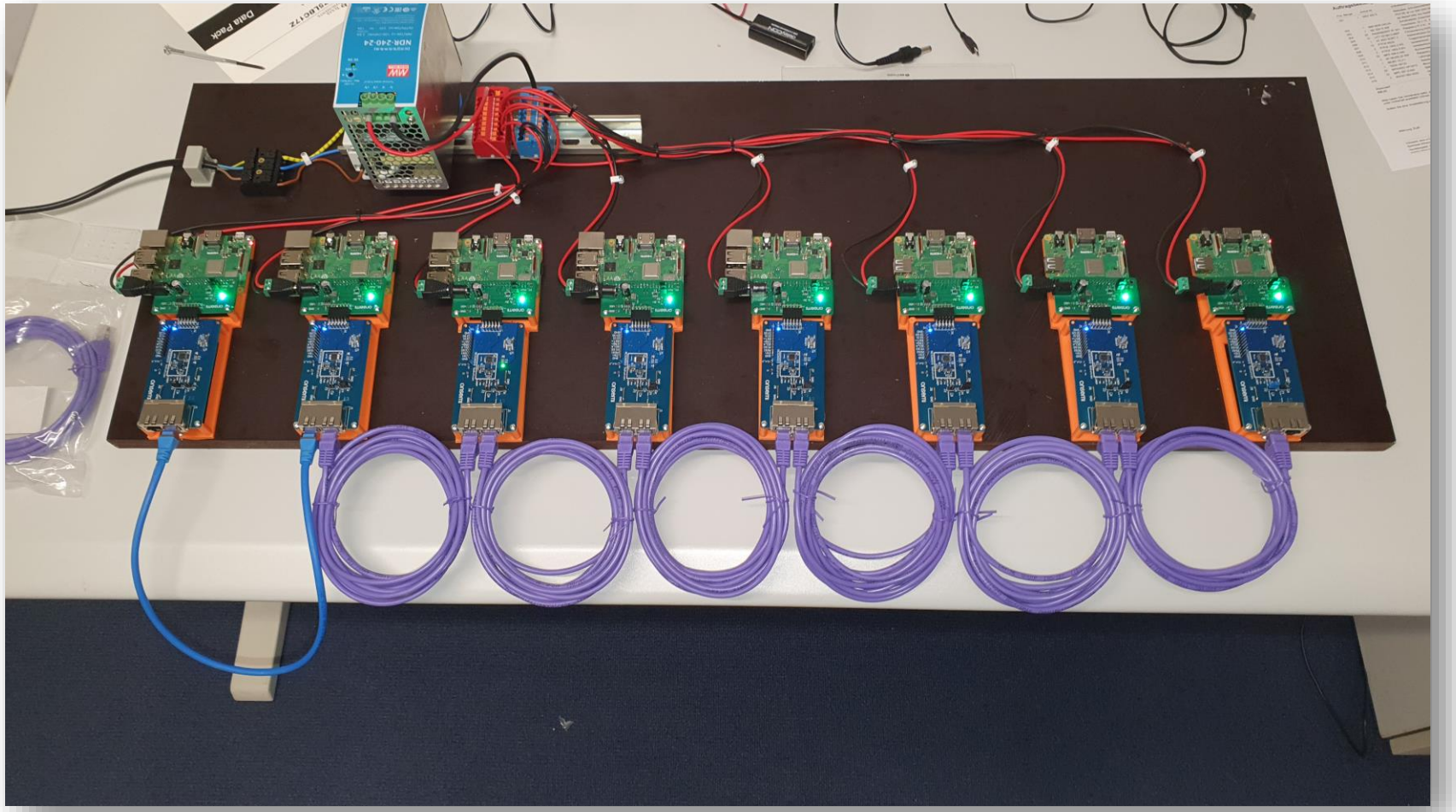
PIN CONFIGURATION

4mm x 4mm QFN
(Top View)

ORDERING INFORMATION
See detailed ordering and shipping information on page 53 of this data sheet.

Bench Example

- 8 stations
- Shows full 10MBit performance
- Shows PLCA
- Demonstrates Enhanced Noise Immunity (ENI)



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