# Single-Pair Ethernet PCB

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**Automotive**  **Single Pair Ethernet**

The CAN vehicle bus has been the industry standard for signal collection from sensors and actuators in vehicles. However, with a limited bandwidth of just 1 Mbps, it no longer meets the demands of modern software-defined vehicles (SDVs), which require high-speed, low-latency data exchange for advanced functions like ADAS, over-the-air updates, and real-time diagnostics.
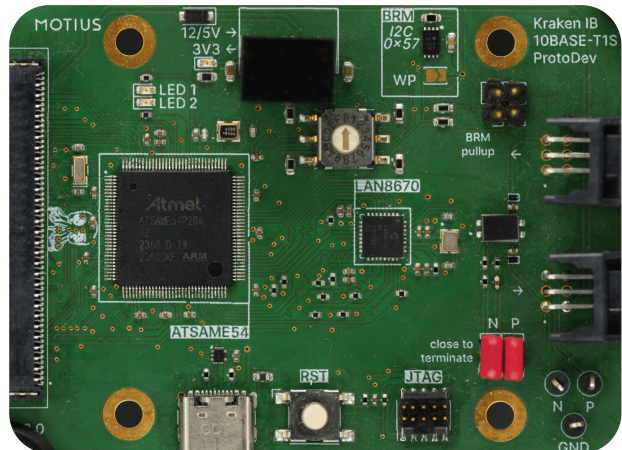


Beyond networking challenges, OEMs struggle with supplier dependency. Critical E/E components—such as sensors, actuators, and ECUs—are tightly integrated into the vehicle architecture, making replacements or upgrades a costly and time-intensive process. The firmware of these components is deeply embedded within the overall vehicle software stack, meaning that changing a single component often requires extensive rework across multiple ECUs, including hardware compatibility adjustments and firmware updates.

## Solution

To overcome the limitations of traditional in-vehicle networking, **10BASE-T1S** provides the missing link in the automotive Ethernet ecosystem. Unlike CAN, 10BASE-T1S enables true **Ethernet-to-the-edge connectivity**, supporting modern **zonal architectures** with higher flexibility, increased bandwidth efficiency, and seamless integration into existing Ethernet infrastructures. By eliminating the need for protocol translation between CAN and Ethernet, 10BASE-T1S **reduces system complexity**, **lowers costs**, and **enhances scalability**. This is also enabled by the **multi-drop nature** of 10BASE-T1S, which drastically simplifies the wiring harness.

In terms of the firmware, an abstraction layer between the E/E components and ECUs is introduced to combat the problem of the supplier dependency of OEMs. By leveraging **Zephyr** as the real-time operating system, a more flexible and modular approach to firmware development is enabled, providing key advantages:

- **Flexible PCB pin definitions** – Enabling easy interchangeability of sensors, actuators, and other E/E components

- **Standardized APIs** – Reducing dependency on proprietary firmware and simplifying software integration

- **Modular driver development** – Ensuring compatibility with a wide range of
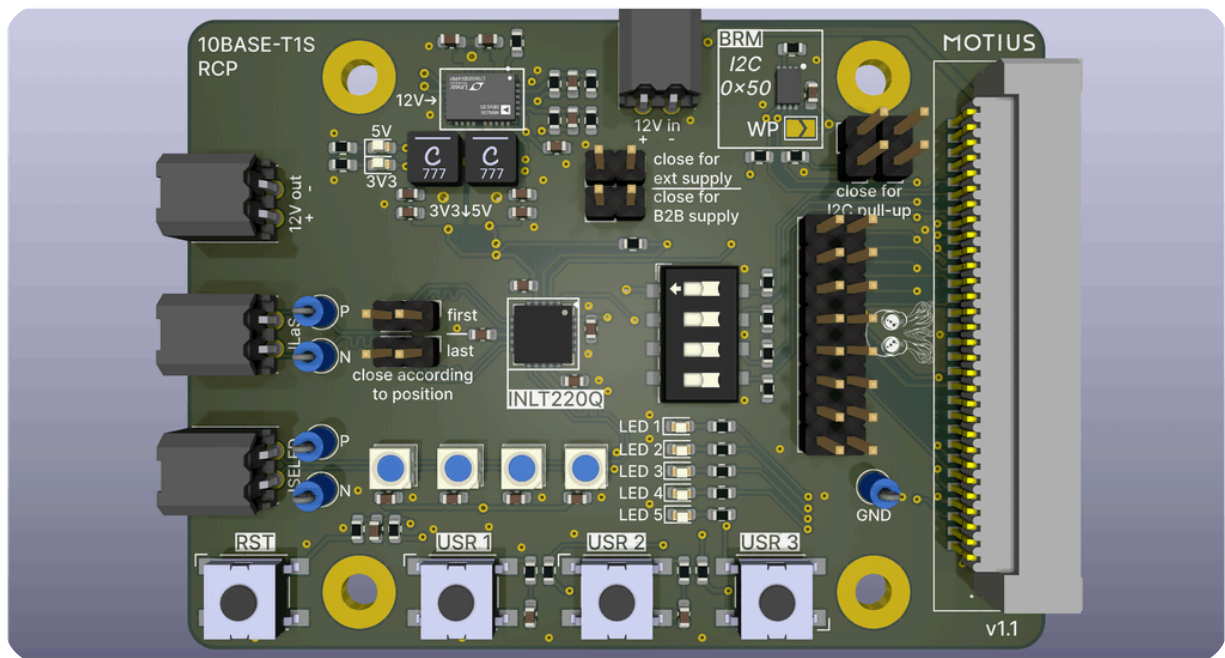
# Technologies Used

☑ Single-Pair Ethernet - 10BASE-T1S

☑ Zephyr

☑ Automotive-grade components

☑ ILaS and ISELED

# Highlights of the Project

- Leveraging 10BASE-T1S (and other single-pair Ethernet) for simpler integration into the vehicle for high bandwidth use cases - Based on the LAN8670 or NCN26010

- Development of PCB prototypes with currently used E/E-components (such as UWB, ILaS & ISELED, etc.) with a 10BASE-T1S as the communication interface

- Controlling LEDs with **ILaS** using the ATSAME54

- Firmware development leveraging Zephyr RTOSs

  - Easy integration of new components and hardware

  - The modular development approach and abstraction layer reduce the board bring-up and testing time
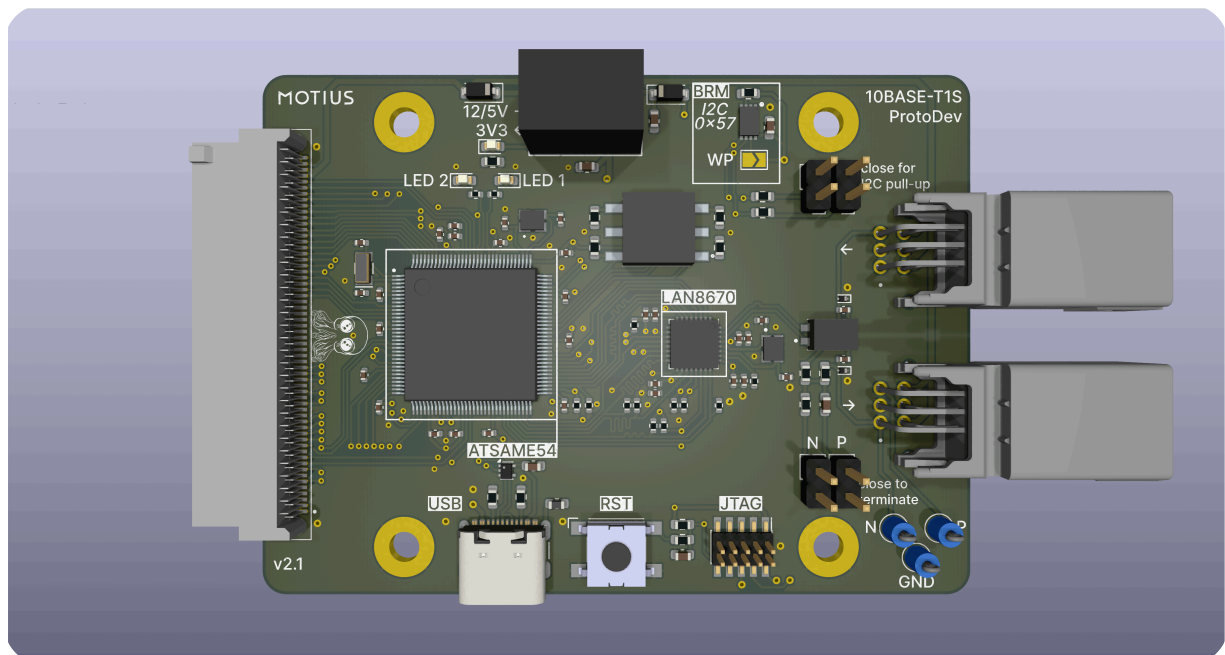


*PCB with the microcontroller and 10BASE-T1S PHY. The microcontroller acts as an abstraction layer the the peripherals connected to the left side connector*

*PCB with the "target" device, in this case a ILaS driver IC and ISELED LEDs*

## Application at Resideo

Motius can support Resideo in the development of new E/E components, using modern embedded system development practices and technologies such as Zephyr, RISC-V, and Single Pair Ethernet.


Resideo Logo