NGAUTO - Objectives

Uses cases, need of different speedgrades

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BOSCH

Supporters

Seeking for supporters for interim meeting on Feb 21./22. …

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Arguments/Market Potential for < 10Gbps

- 2.5Gbps and 5Gbps causes less thermal power loss than a 10GBps PHY. Power consumption of a 10Gbps PHY is about 2.5 W (roughly estimated)

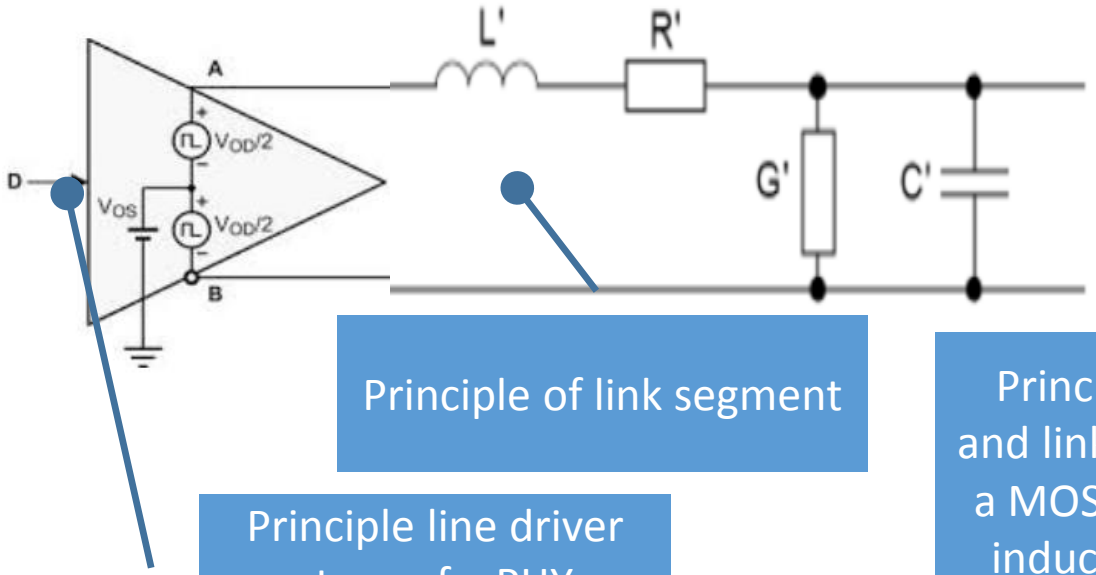
- By demand of “environmental” tightness and often worst-case installation conditions of automotive components (ECUs,cameras,…), efficient cooling is complex and expensive (huge PCB footprint, high counts of PCB layers, heatpipes,…). It is a fact, based on camera development by automotive suppliers, that every mW of thermal power loss has to be avoided.

- Applications like connectivity units, “none machine vision” cameras and radar do not require speeds of 10GBps. OEMs would not pay for technological overhead

- Actually there are some none standard <10Gbps solutions on the market. By excluding <10Gbps options from the standard, those custom-build solutions will further exist in the future. This fact lowers the broad-market potential for a single 10Gbps solution/standard.

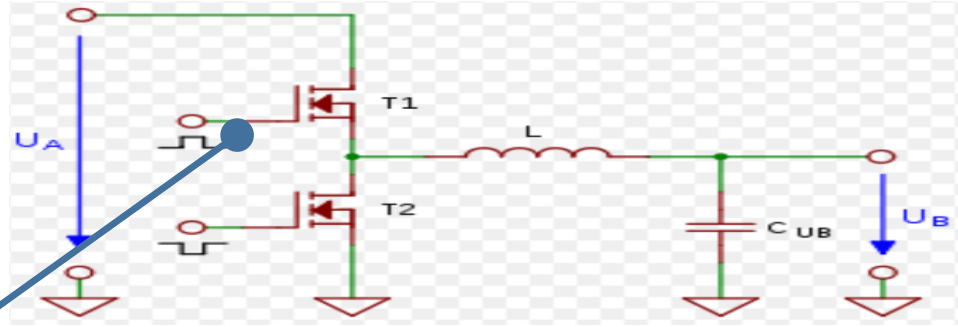
Arguments/Market Potential for < 10Gbps

Power consumption/power loss in relationship to communication speed, instancing a principle line driver outputstage of a Ethernet PHY.



Principle line driver stage of a PHY

Principle of link segment



Principle of driver stage and link segment, similar to a MOSFET halfbridge with inductive and capacitive load

$$P_{SW_f} = f_{schalt} \cdot E_{ON}$$

$$P_{SW_r} = f_{schalt} \cdot E_{OFF}$$

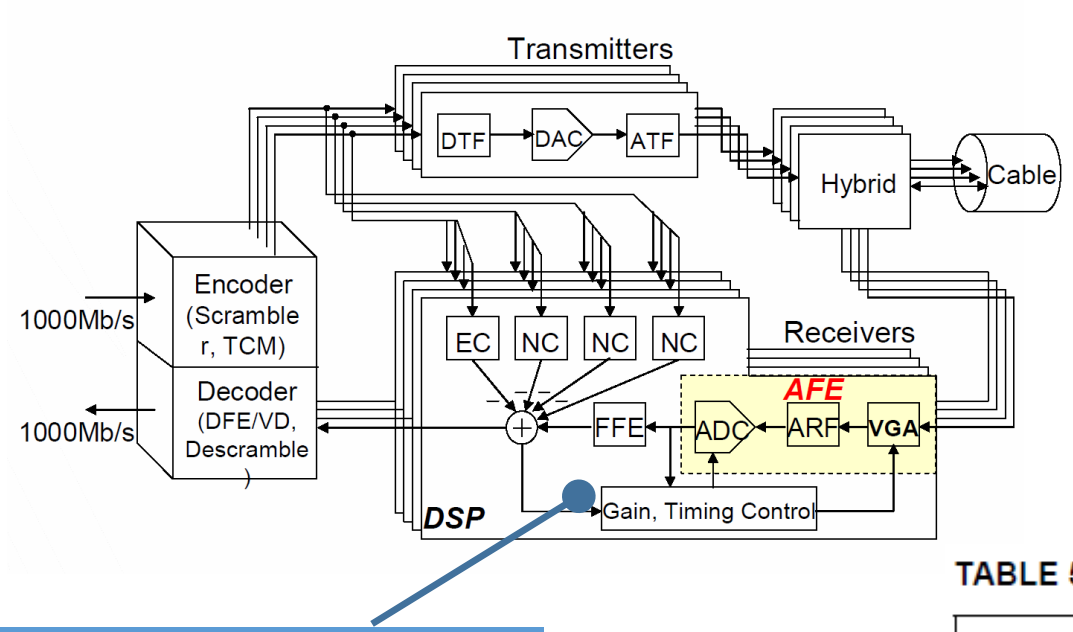
By driving cables with high frequency, power is needed:

- **Recharging cable capacity**
- **Switching losses of PHY output stage**

this thought does not consider the line coding (NRZI,PAM,MLT3….)

Arguments/Market Potential for < 10Gbps

Complex signal shaping (e.g PAM) and full duplex operation on Gigabit-Ethernet requires complex signal recovery algorithms. (echo canceler, adaptive equalizer,….)



High numbers of DSP Blocks increase power dissipation ! *)

Large numbers of DSP blocks increases power consumption

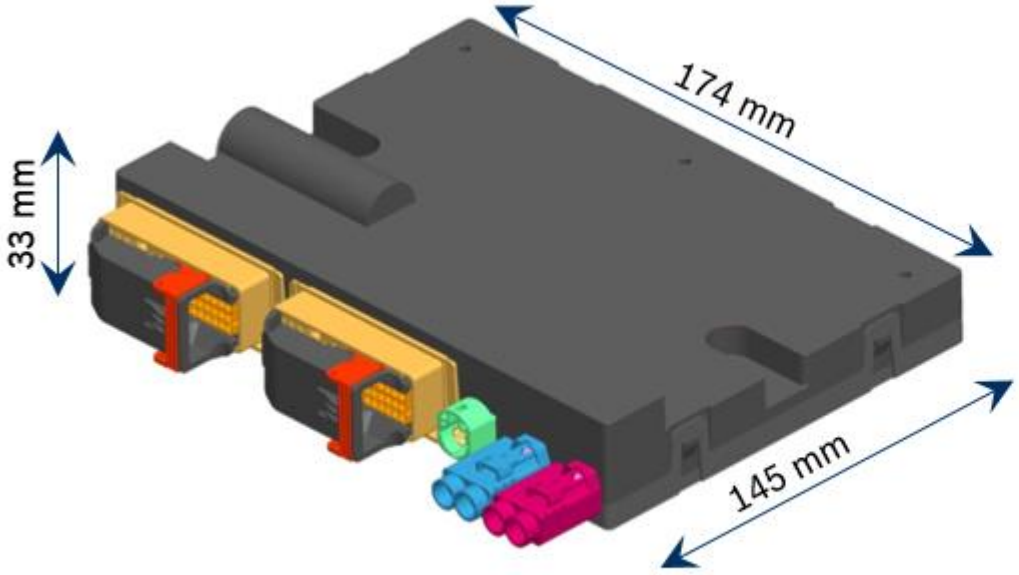
*) this problem could be handled very well these days with a modern silicon process

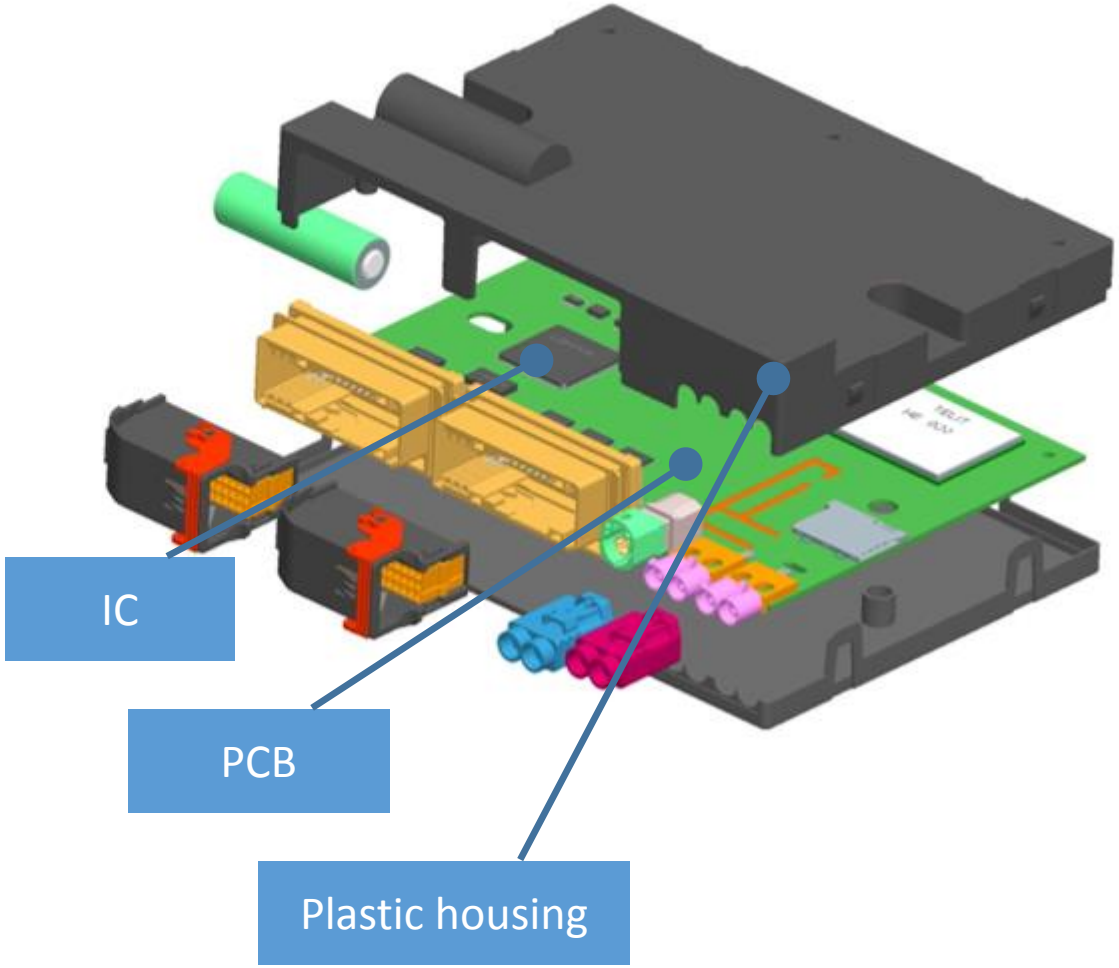
TABLE 5-1: POWER CONSUMPTION - 1000BASE-T LINKED

Parameter	Typical	Unit
Supply Current (VDDVARIO) (@ +3.3V)	36	mA
Supply Current (VDD12CORE, VDD12BIAS, VDD12PLL, VDD12A) (@ +1.2V)	454	mA
External Magnetics Current (@ +3.3V)	202	mA
Total Power Dissipation (Device Only) (Note 5-5)	665	mW
Total Power Dissipation (Device and Ethernet components) (Note 5-5)	1331	mW

Arguments/Market Potential for < 10Gbps

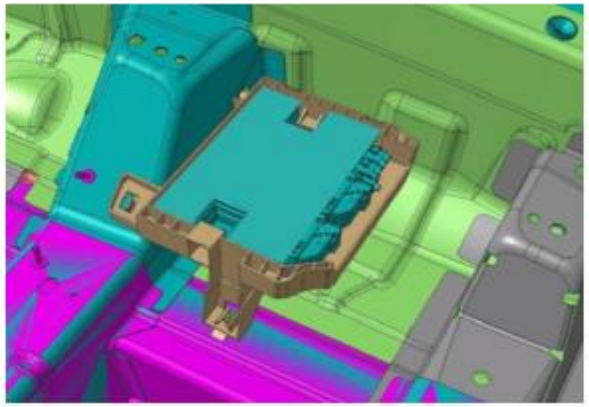
Cooling situation inside a typical automotive ECU:



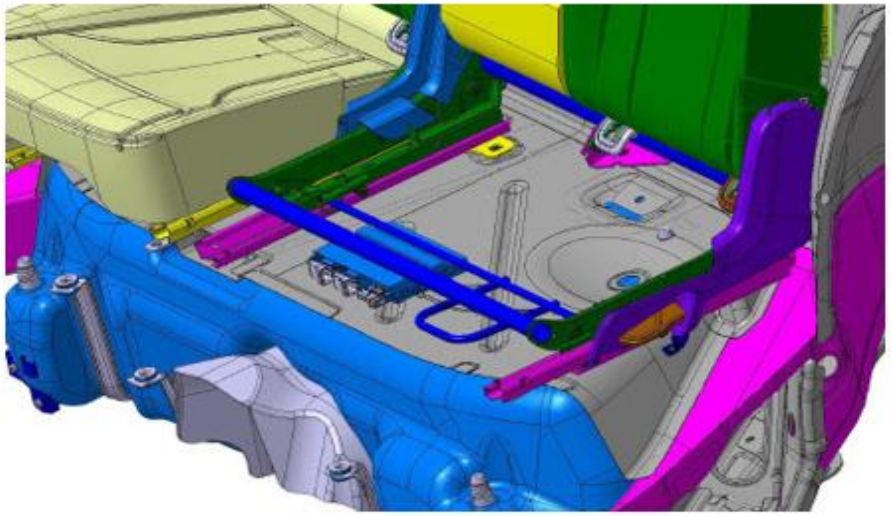


Arguments/Market Potential for < 10Gbps

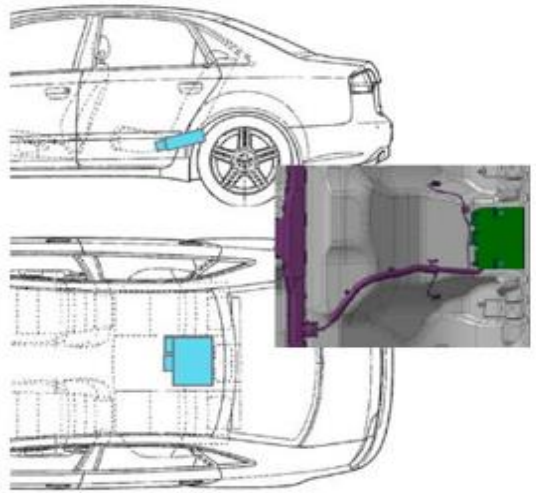
Cooling situation inside a typical automotive ECU, vehicle inside installation locations:

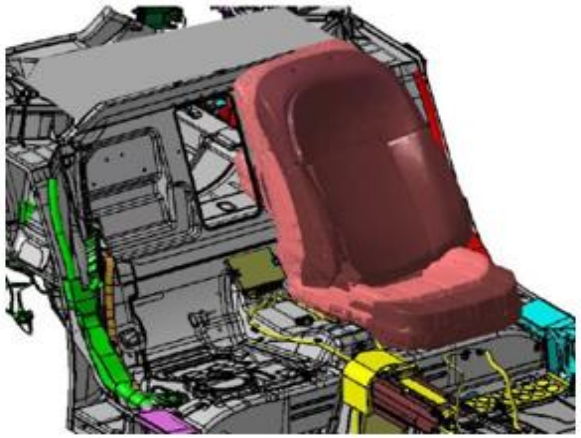


A – below driver seat



C – below rear seats

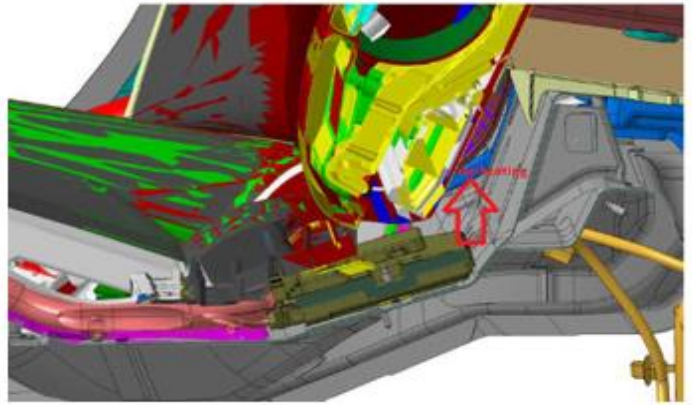




B – below rear seats

Packaging area 8 (Driver compartment)

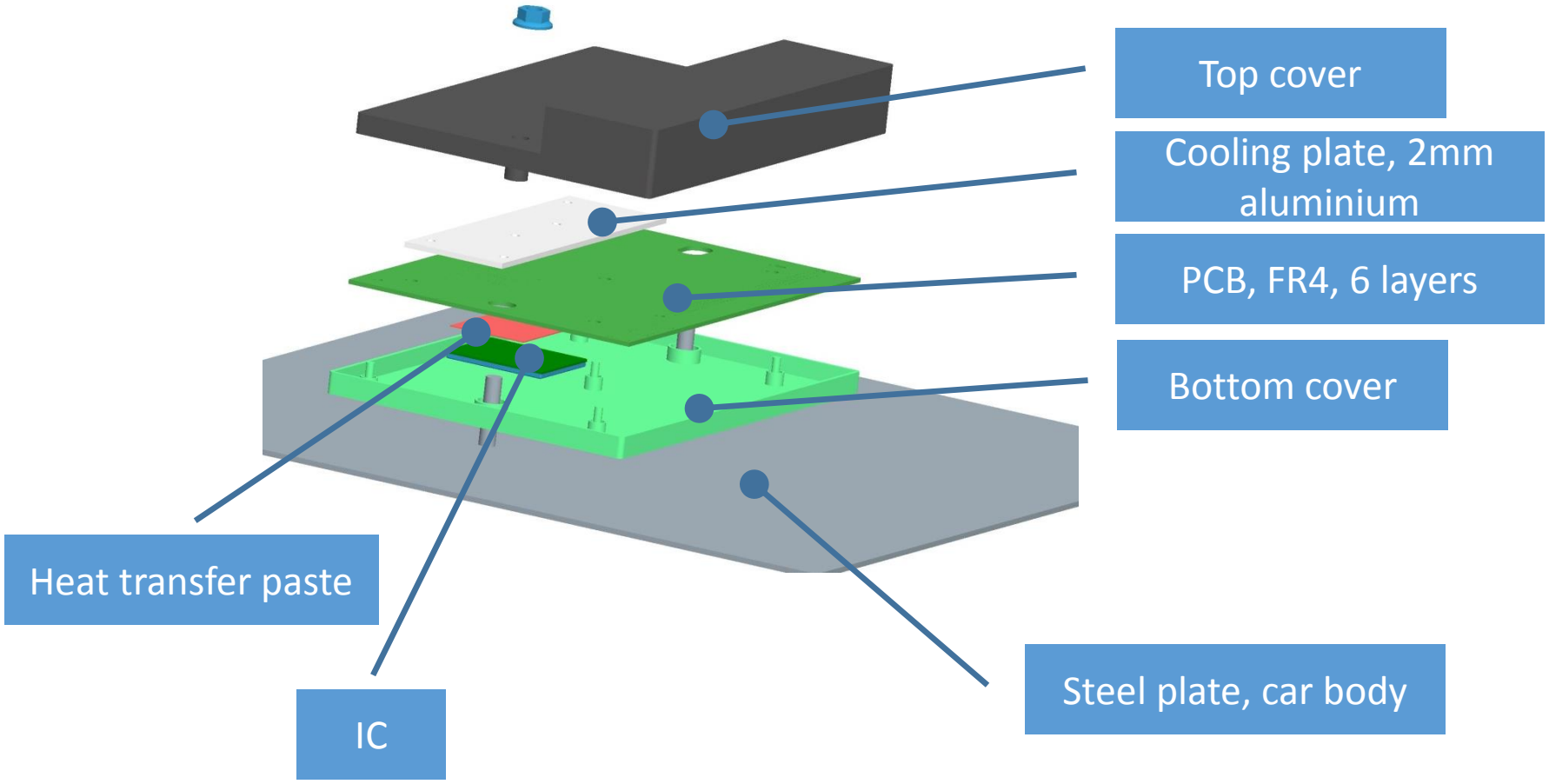
- protection class IP5K2
- T_{min} = - 40°C
- T_{max} = +85°C
- T_{max} = +100°C (housing)



D – below rear seats

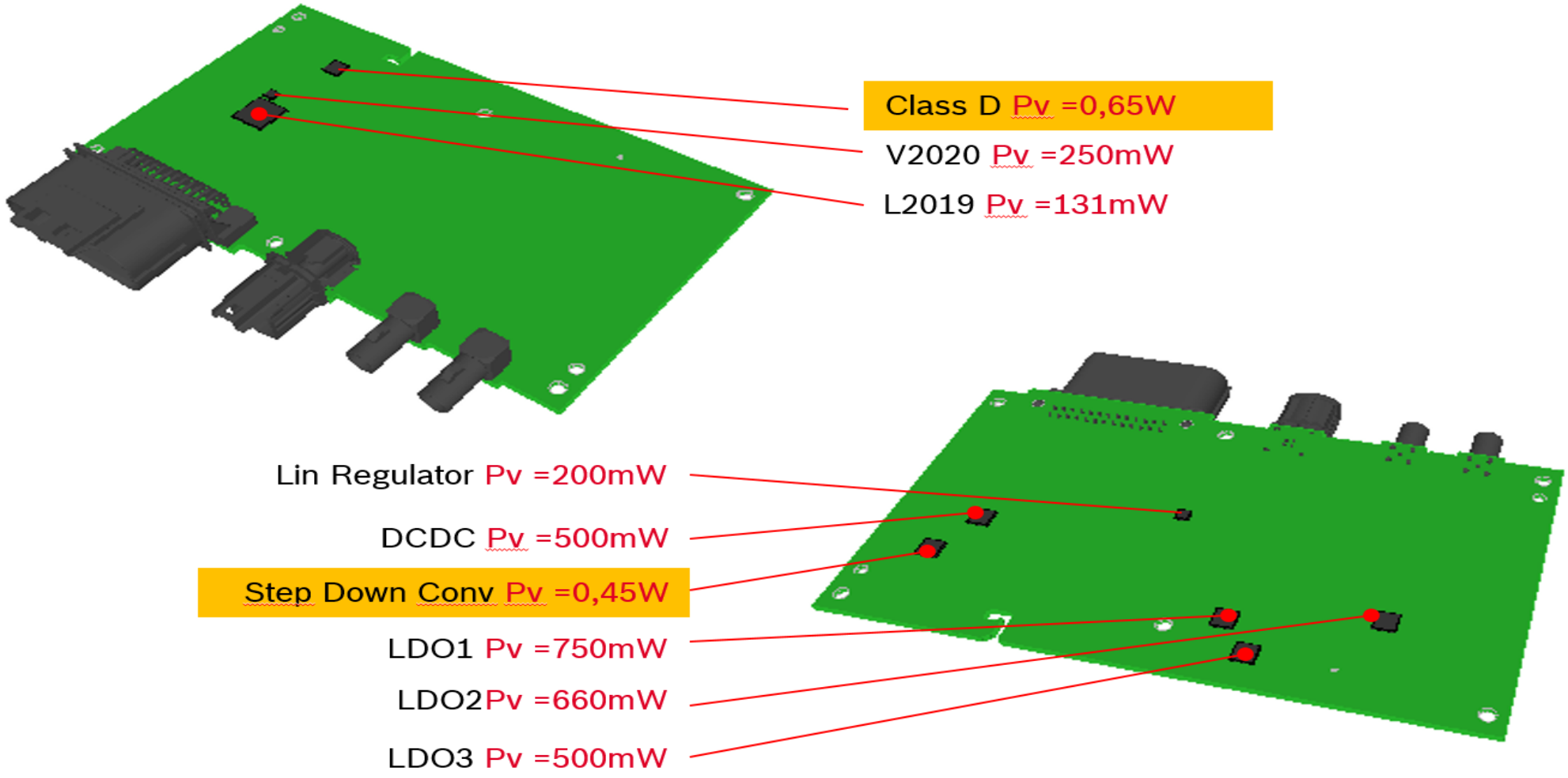
Arguments/Market Potential for < 10Gbps

Cooling situation inside a typical automotive ECU, thermal simulation experimental setup:



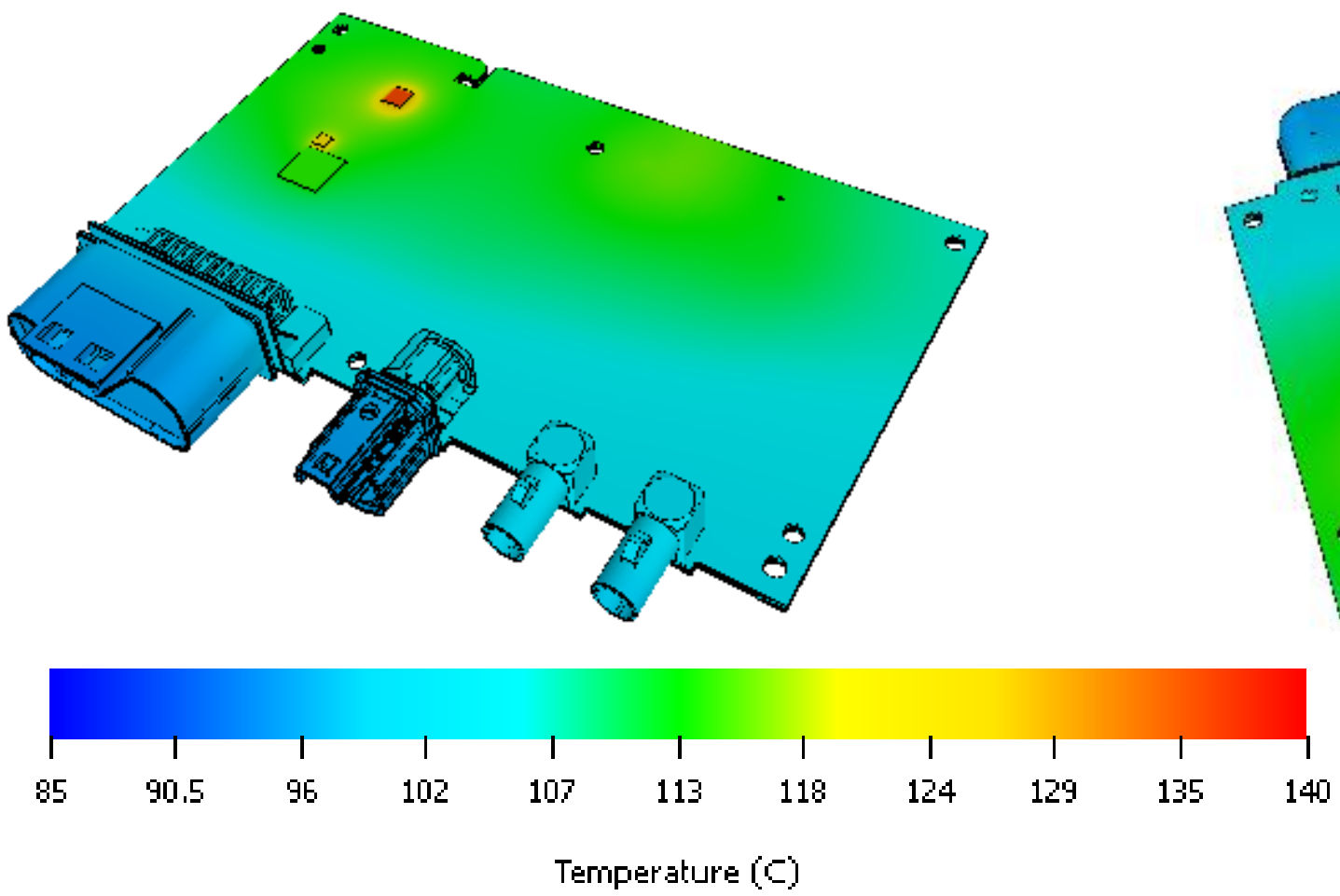
Arguments/Market Potential for < 10Gbps

Cooling situation inside a typical automotive ECU, experimental setup, overall Ploss=3,80W:



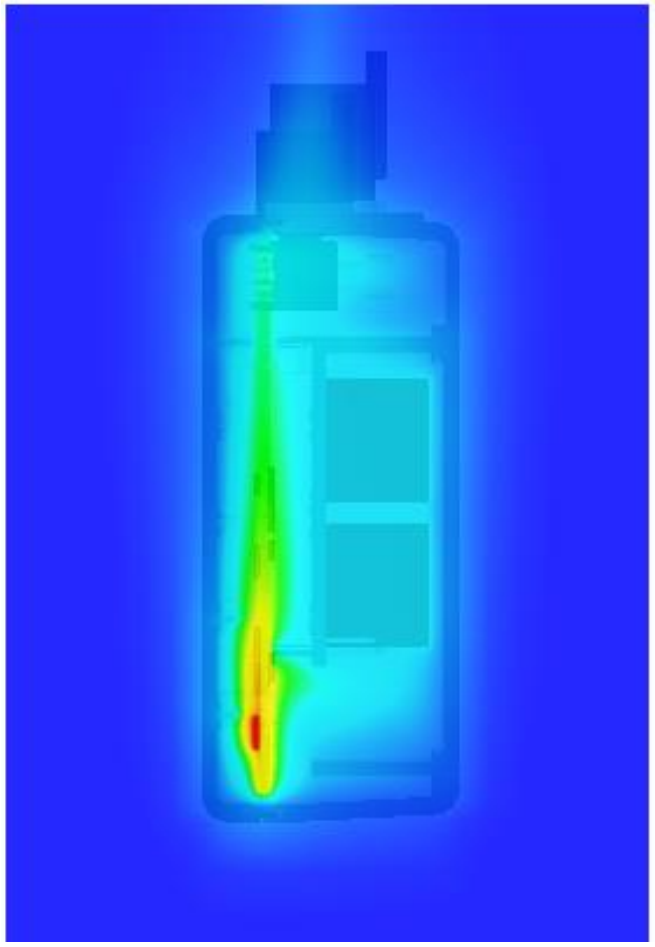
Arguments/Market potential for < 10Gbps

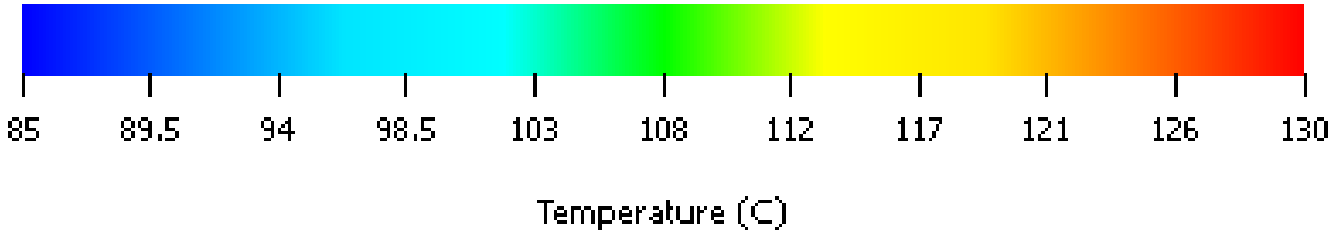
Cooling situation inside a typical automotive ECU, simulation results @ 85°C ambient:

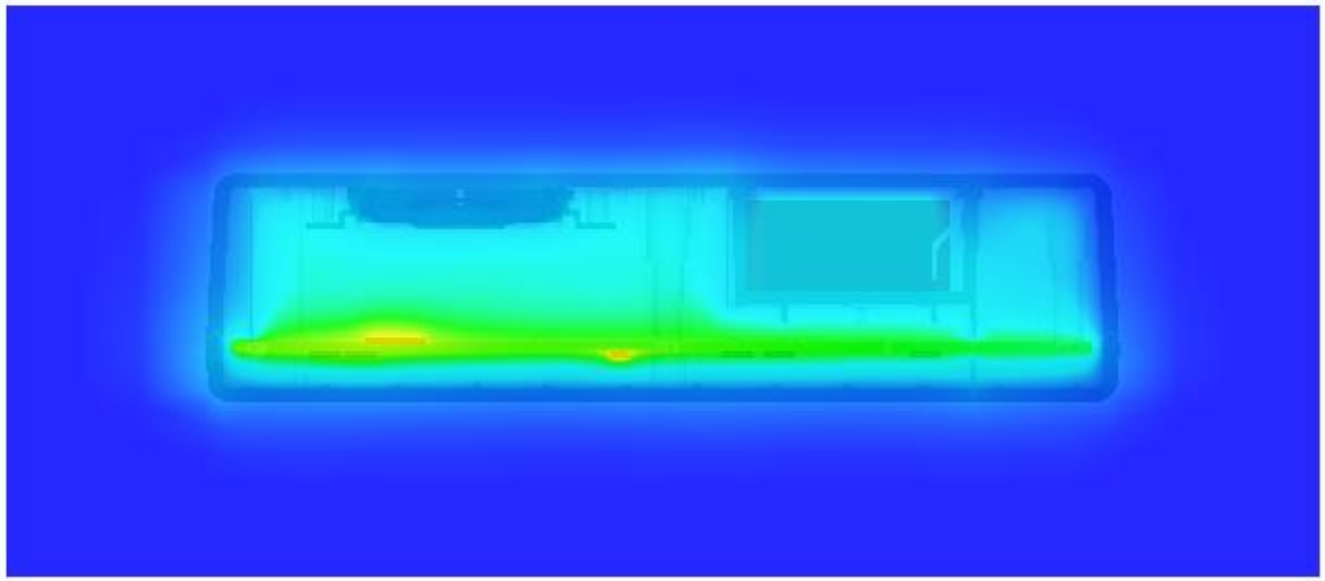


Arguments/Market Potential for < 10Gbps

Cooling situation inside a typical automotive ECU, simulation results @ 85°C ambient:



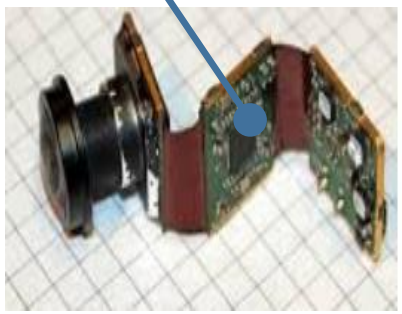




Arguments/Market Potential for < 10Gbps

Heat dissipation, automotive camera:

foldable PCB stack

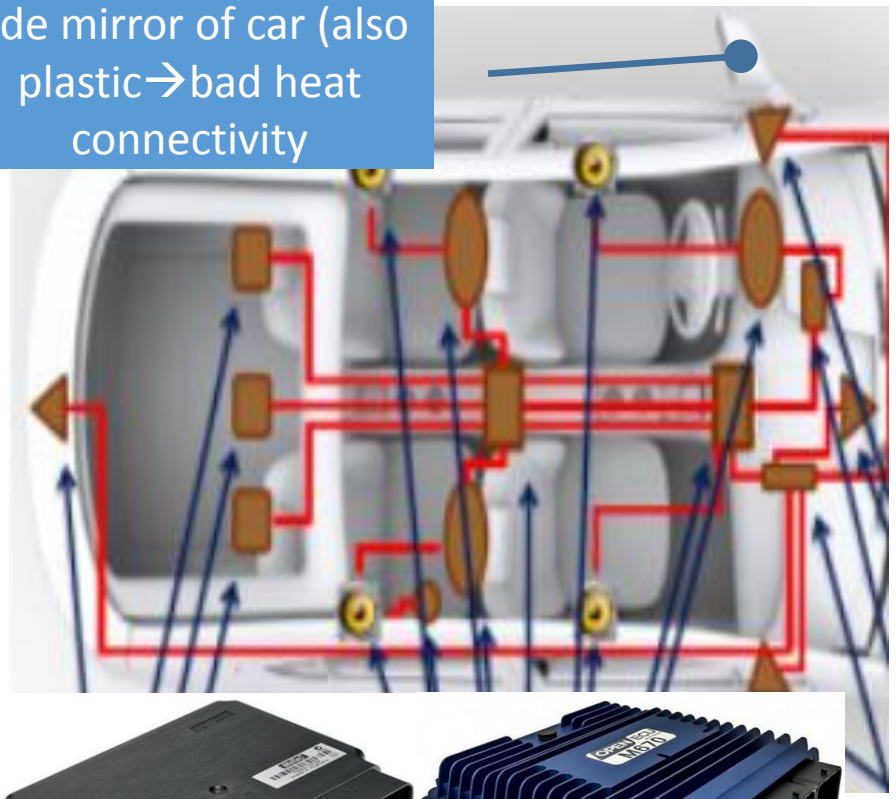


Plastic housing, less heat conductivity

PCB stack folded, no cooling space at all

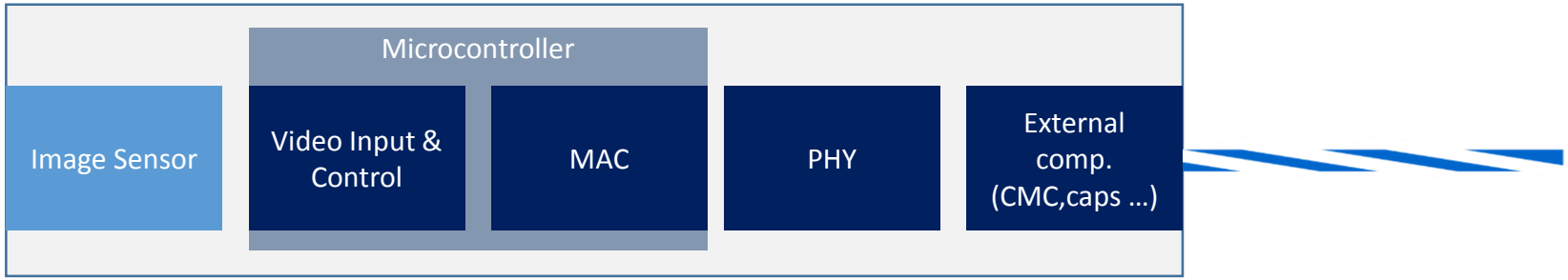
Typical automotive ECUs

Camera mounted in side mirror of car (also plastic→bad heat connectivity



Arguments/Market Potential for < 10Gbps

Ethernet vs. SerDes camera



Ethernet based camera (uncompressed video)

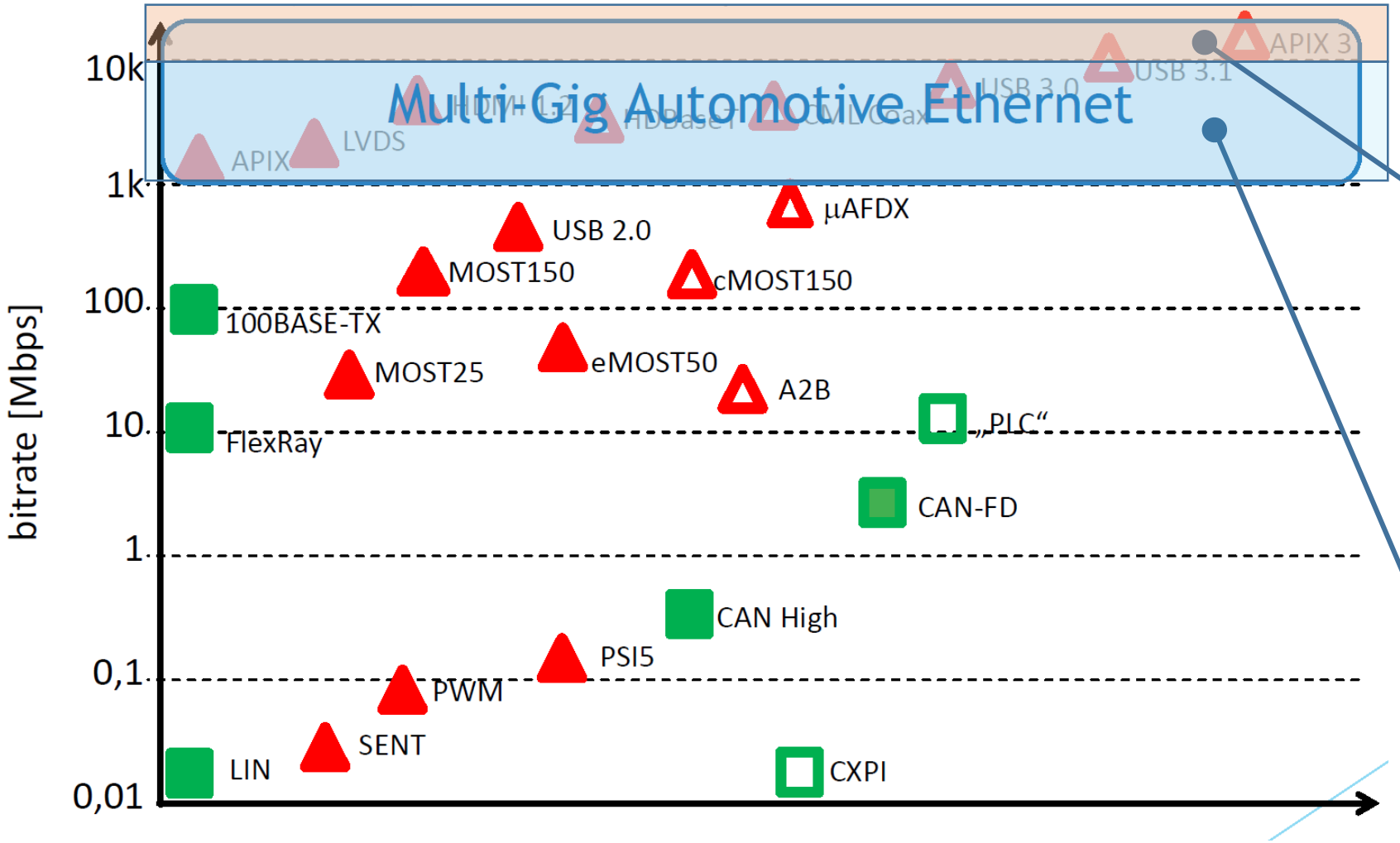
- Power consumption of a current **1.2** Mpixel/16Bit color depth,100 Mb -> **1.3 W**

SerDes based camera (uncompressed video)

- Power consumption of a current **2** Mpixel/16Bit color depth,6Gb SerDes -> **0.95 W**

Arguments/Market Potential for < 10Gbps

Excluding <10GB would **decrease** market potential, because custom solutions will further exist



Only this usecase area will be determined by the standard

This usecase area will be covered by the current custom, proprietary solutions in the future

Arguments/Market Potential for < 10Gbps

Summary:

- 2.5Gbps and 5Gbps cause lower power losses than a 10Gbps PHY
- Inside an ECU or automotive camera cooling is very difficult
- Some applications do not require 10Gbps, but slightly more then 1Gbps
- Excluding <10Gbps solution will decrease market potential of the standard

The approach for lower speeds less than 10Gbps does **not exclude** a 10Gbps solution. 10Gbps speed is **neccessary** !

Thank You !