

Automotive Ethernet  
PCIe  
DDR/LPDDR  
SERDES  
MIPI  
Power/signal integrity  
EMI debugging

CPU  
Central  
Processing  
Unit

FLC22388557

FLC22388557

Automotive test solution

# DOMAIN CONTROLLERS AND HIGH-PERFORMANCE ECUs

**ROHDE & SCHWARZ**

Make ideas real



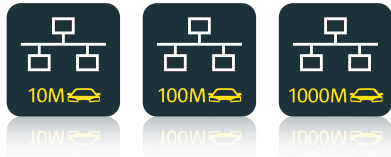
# YOUR CHALLENGE

Domain/zone controllers are expected to replace functionality that is currently performed by a vast number of ECUs. These controllers must be reliable, robust, able to handle massive amounts of data fast and communicate with various other components (sensors, actuators, ECUs, gateways) using different communication protocols (automotive Ethernet, CAN-FD, SERDES, etc.) within the same unit.

## In-vehicle signals

Testing and debugging of communication protocols between domain controller and in-vehicle networks.

### Automotive Ethernet



### CAN/CAN-FD

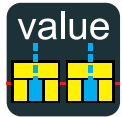


## Performance and debugging

Trigger and decode, EMI debugging, boot-up time measurements and bus timing analysis.

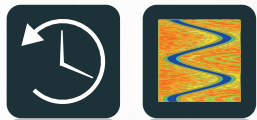
### Boot-up time

### Redundancy switchover time



### Trigger and decode

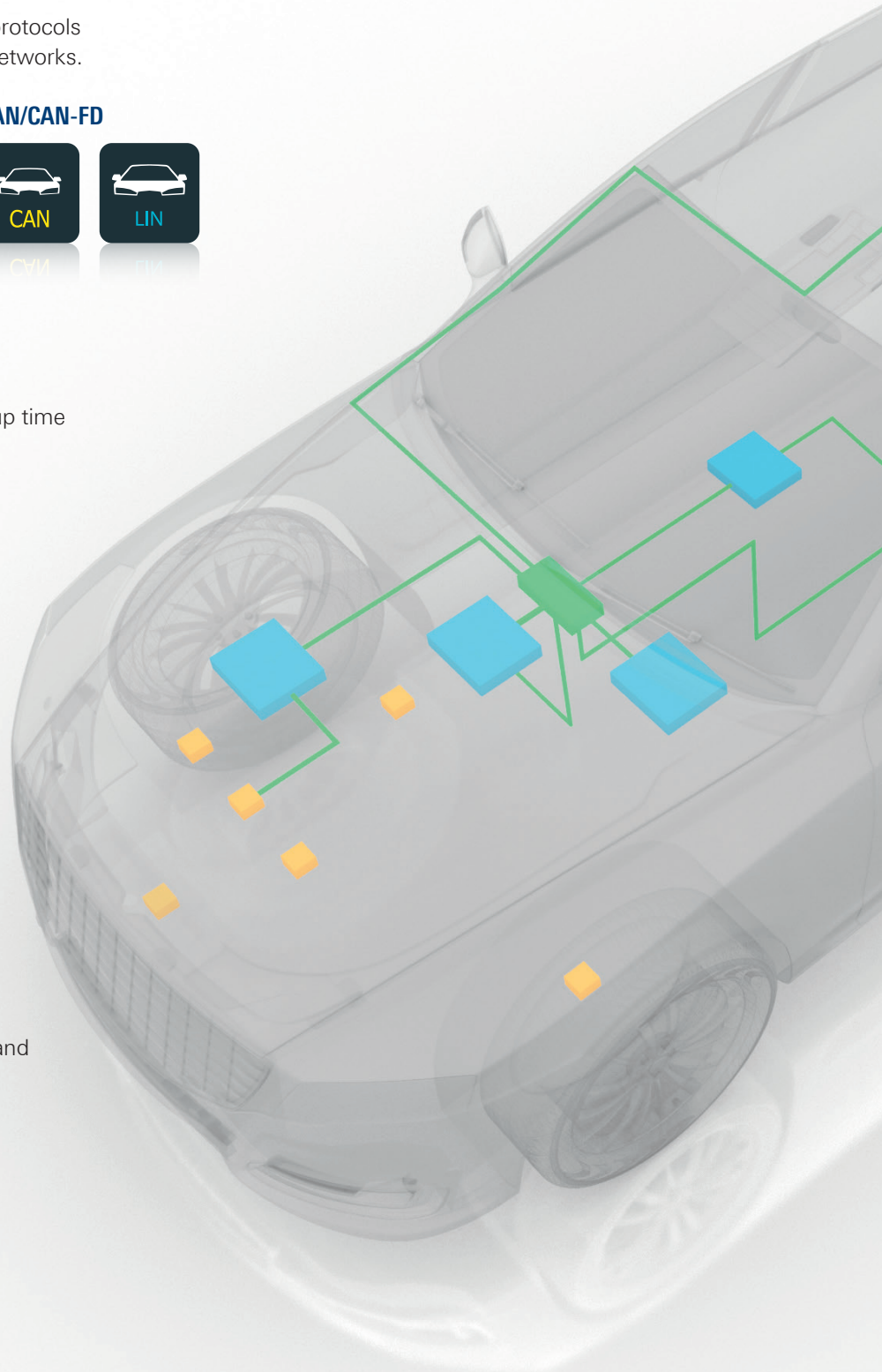
### EMI debugging



## TDR/TDT

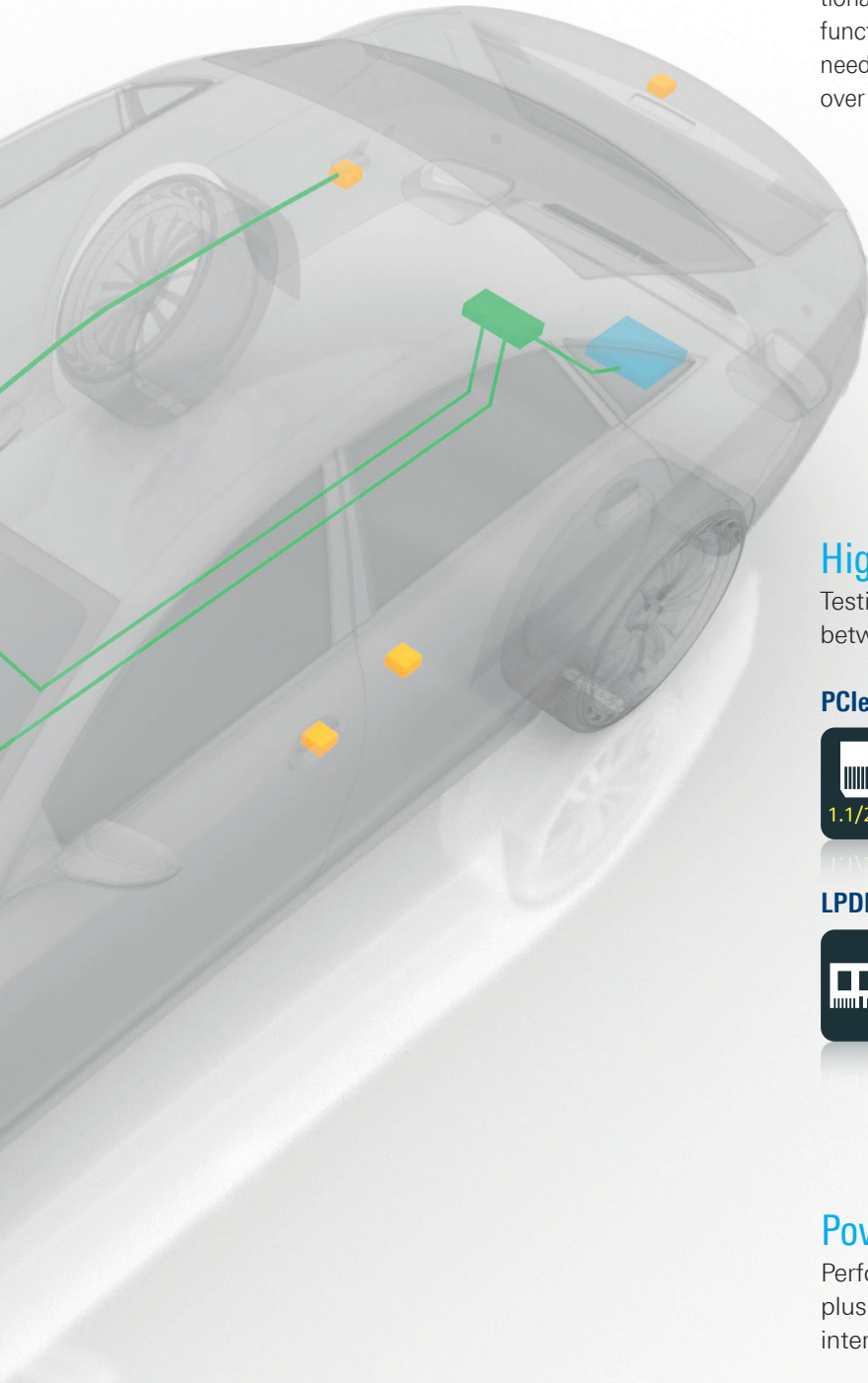
Accurately measure impedance mismatch and microreflections between any components throughout the in-vehicle networks.

### TDR/TDT



# YOUR TASK

Engineers working on domain controllers need to verify signal integrity on high-speed digital interfaces such as PCIe, SERDES and automotive Ethernet while ensuring that traditional communications such as CAN-FD, LIN and MIPI also function as expected. Furthermore, domain controllers will need to have low levels of EMI and be able to rapidly switch over to a redundant system in case of a malfunction or failure.



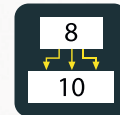
## High-speed serial interface debugging

Testing and debugging of communication protocols between domain controller and in-vehicle networks.

### PCIe Gen 2/3



### SERDES



### LPDDR4



### MIPI D-PHY



## Power and signal integrity

Perform accurate power analysis across your designs, plus detailed signal integrity testing on high-speed digital interfaces with the fastest acquisition rate.

### Power integrity SMPS power measurements



### Jitter separation



# INTRODUCTION

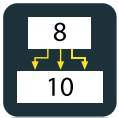
Developments in advanced driver assistance systems (ADAS) are triggering new approaches to in-vehicle network (IVN) architecture design. With today's vehicles deploying at least a hundred electronic control units (ECUs), the current network architecture has reached its limits. The automotive industry is now focusing on a domain or zonal controller architecture to simplify network design and maximize performance. A domain controller can potentially replace the functions of many ECUs, providing capabilities for high-speed communications, sensor fusion and decision-making, and supporting high-speed interfaces for cameras, radar and LiDAR.



# DOMAIN CONTROLLERS AND HIGH-PERFORMANCE ECUs



PCIe Gen 3.0 compliance tests with the R&S®RTP-K122 software option; PCIe supports speeds up to 8 GT/s.



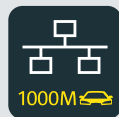
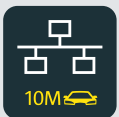
SERDES serial decoding with the R&S®RTP-K52 software option for buses up to 6.25 Gbit/s. The R&S®RTP is the optimal solution, with realtime deembedding, extremely fast update rate, clock data recovery (CDR) and advanced jitter analysis capability. The R&S®RTP-K140/-K141 software options additionally deliver a high-speed serial pattern trigger with a maximum nominal data rate of 8 Gbps/16 Gbps.



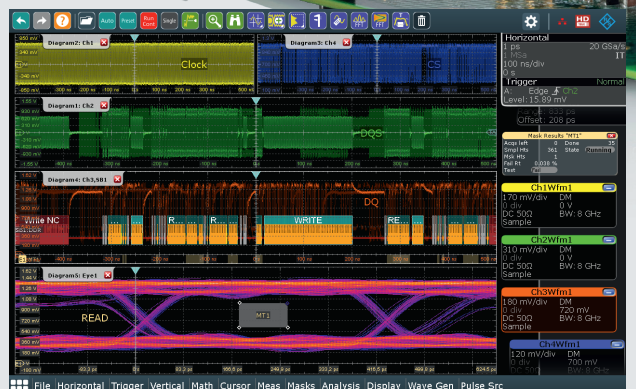
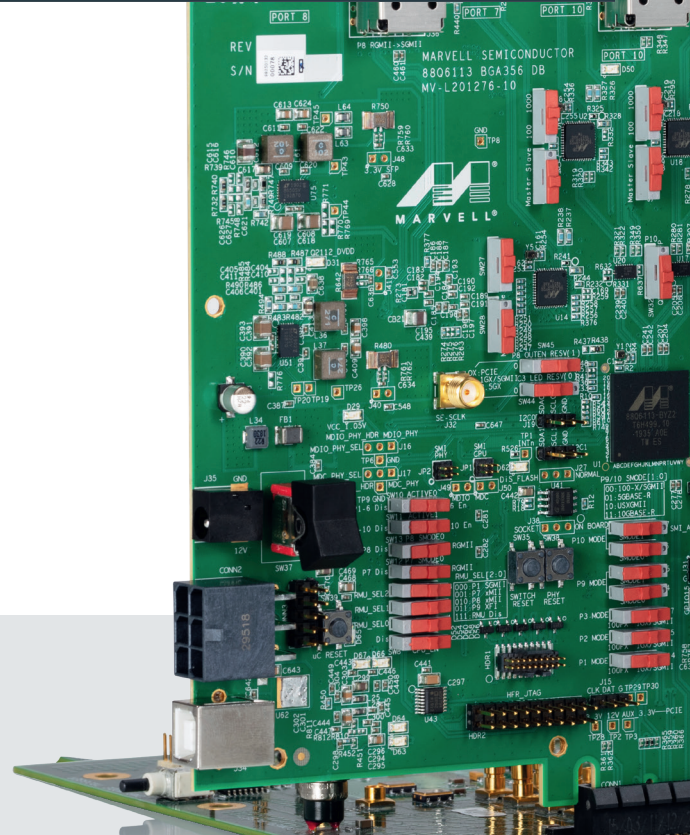
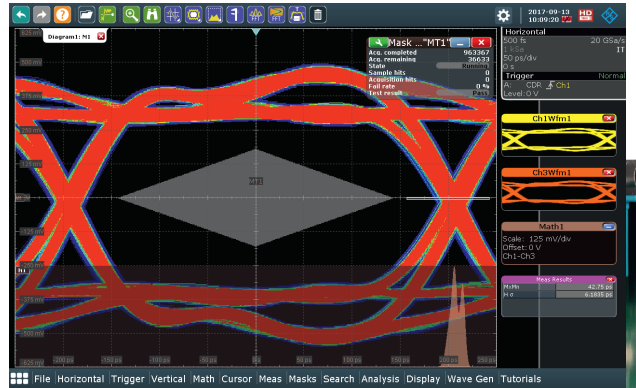
MIPI D-PHY triggering and decoding for up to 4-lane designs with the R&S®RTP-K42 software option. Decoding uses fixed clock speed or direct clock measurement; results are displayed as color-coded telegrams and in tabular form.

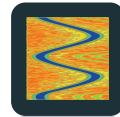
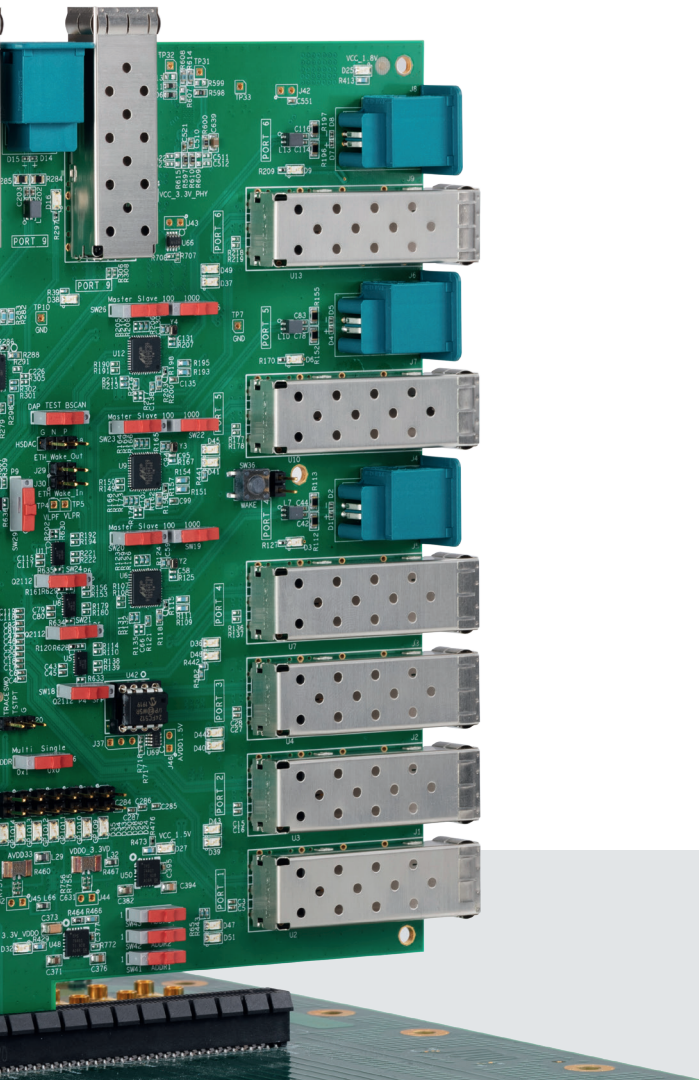


DDR4 and LPDDR4 automated compliance tests with the R&S®RTP-K93 software option. Other supported functions include signal integrity debugging (with eye diagram analysis) and decoding of read and write cycles.



Automotive Ethernet compliance tests: future-ready solutions for speeds up to 10GBASE-T1 with the R&S®RTP-K57, R&S®RTP-K89 and R&S®RTP-K87 software options. CAN/CAN-FD, LIN and other common automotive bus standards are also supported.





High-speed serial pattern trigger up to 16 Gbps with the R&S®RTP-K140/R&S®RTP-K141 software options features clock data recovery (CDR). Perfect for debugging embedded clock signals (line coding, PCIe interrupts, histogram, data eye mask tests).

In addition, the R&S®RTP provides spectrum analysis capability for detailed EMI debugging.



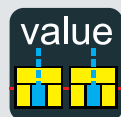
Jitter measurements with the R&S®RTP-K133 software option measuring deterministic jitter (DJ) and total jitter (TJ) are now mandatory requirements for DDR4/LPDDR4 applications.



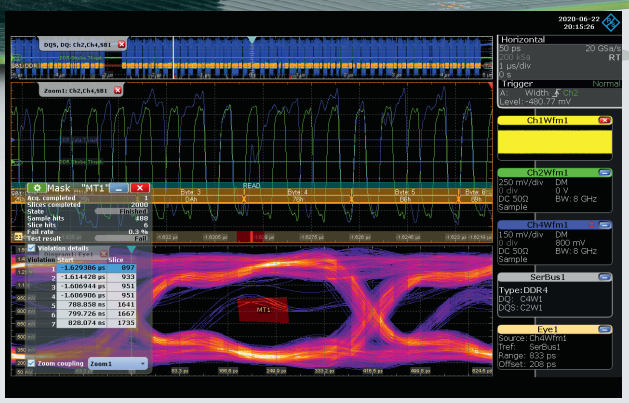
TDR/TDT analysis with the R&S®RTP-K130 software option and the R&S®RTP-B7 hardware option, which delivers a 16 GHz differential pulse signal. Perfect solution for PCB debugging.



Power analysis with the R&S®RTP-K31 software option. It provides all essential measurement functions for analyzing power electronics and supports automated test configuration and customizable test reports for all power measurements.



Bus timing measurements with the R&S®RTP-K35 software option allows you to measure frame-to-frame time. Get the full bus error statistics including total frame errors, percentage of erroneous frames in relation to total frames, and the rate of consecutive frame errors.



# ALL-IN-ONE R&S® RTP OSCILLOSCOPE

## Signal integrity in realtime

The R&S®RTP high-performance oscilloscope combines high-class signal integrity with a fast acquisition rate. Customized frontend ASICs and realtime processing hardware enable highly accurate measurements at unprecedented speed in a compact form factor.

- ▶ Quickly find signal faults with 750,000 waveforms/s
- ▶ High-precision digital trigger without bandwidth limitations
- ▶ Realtime deembedding for triggering and fast acquisition
- ▶ Compact design and silent operation for best fit to any lab
- ▶ Precise measurements due to flat frequency response of  $\pm 0.25$  dB



### Service that adds value

- ▶ Worldwide
- ▶ Local and personalized
- ▶ Customized and flexible
- ▶ Uncompromising quality
- ▶ Long-term dependability

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- ▶ Energy efficiency and low emissions
- ▶ Longevity and optimized total cost of ownership

Certified Quality Management

ISO 9001

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