DRIVING THE DATA-FUELED FUTURE

End-to-End Data Connectivity Solutions for the Automotive Industry
Meeting Data Connectivity Design Challenges

Recently developed sensor and camera systems for ADAS, infotainment systems with high-resolution (4K) displays and external cellular and V2X connectivity present engineers with increasing demands in terms of data rates, bandwidth, chip technology compatibility as well reliability and spatial constraints.

Our automotive data connectivity portfolio has therefore been developed according to the following design principles to meet these challenges:

- **Performance**: Supporting data rates up to 25Gbps.
- **Robustness and Reliability**: Automotive-grade interfaces with shielding (EMI), waterproofing and vibration resistance.
- **Smart Design**: Miniaturized and modular design for optimum architecture integration.
- **Chip Protocol Optimized**: High channel performance according to multiple chip manufacturer physical layer specifications.

Engineering the Next Generation of Mobility

The next-generation of mobility will be defined by safer, more sustainable and convenient ways of moving around. As a global leader in connectivity and sensor solutions, we collaborate with our customers and other industry technology leaders to co-create engineering solutions that address the physical and wireless automotive connectivity challenges that will enable this vision.

Leveraging 75+ years’ experience in the automotive industry; developing highly robust, high-performance connectivity solutions, TE Connectivity’s (TE’s) powerful data connectivity portfolio offers high-speed data interconnection products based on all major transmission technologies designed for the increasing performance demands of automotive in-vehicle networks, infotainment and ADAS applications.

In addition, our portfolio of HIRSCHMANN MOBILITY technologies offer wireless solutions for services such as cellular, bluetooth, WiFi, GNSS, broadcast and V2X.
TE Connectivity
Data Connectivity Capabilities

Our portfolio of automotive data connectivity systems has been designed specifically to meet the requirements of harsh automotive environments. Compliant with standards such as LV214 and USCAR, our products meet the requirements, in terms of moisture and vibration resistance.

In addition, they are tested against stringent specifications for signal integrity and electromagnetic compatibility, such as the One-Pair Ethernet (OPEN) Alliance Technical Committee.

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| MATEnet          | Twisted Pair  | 1 GHz     | 1000BASE-T1, 100BASE-T1, HDBaseT, PCIe A2B / C2B | 1Gbps for Ethernet (up to 4 Gbps for alternative technologies) | • In Vehicle Networking: Ethernet/PCIe
• Rear View Cameras
• Multimedia (HDBASET) |
| HSD/HSL          | Star Quad     | 2 GHz     | SerDes: GMSL1, FPDIII, APIX2, USB 2.0          | 3Gbps (6 Gbps dual lane)                    | • Dashboard/ Touch Screens
• HD Screens
• USB Connections |
| **NEW** Mult-gig Ethernet Connectors | Twisted Pair  | 20 GHz    | SerDes: GMSL2/3, FPD-Link III/IV, APIX3, MIPI | 12 Gbps (NRZ) 24 Gbps (PAM4)                  | • Autonomous Driving
• Radar / Lidar
• High-res. (4K) Displays |
| MATE-AX          | Coaxial       | Typical: 9 GHz (Potential 15 GHz) | SerDes: GMSL2/3, FPD-Link III/IV, APIX3, MIPI Analog (Antennas) | 12 Gbps (NRZ) 24 Gbps (PAM4)                  | • 4K Cameras
• Sensors
• High-res. Displays
• WLAN Antennas
• Mobile Internet (3G/LTE) |
| FAKRA            | Coaxial       | 6 GHz     | SerDes: GMSL2/3, FPD-Link III/IV, APIX3, MIPI Analog (Antennas) | Up to 6 Gbps                                 | • Broadcast Antennas
• GPS
• Cellular (GSM)
• Bluetooth
• Keyless Entry |
| USB Type-C 3.1   | Twisted pair  | 5 GHz and up | USB 3.1 Gen (potential for Gen 2) USB 2.0 DisplayPort | Up to 5Gbps (potential for up to 10Gbps) | • USB Connectors
• USB Power delivery (5A)
• HD Display |
End-to-End Data Connectivity Expertise

In addition to a comprehensive portfolio of terminals, connectors and headers for all connection types, TE provides end-to-end support for application links. This includes helping engineers to find the right solution for an application by understanding the complete link performance, component limits, radio frequency (RF) simulation and optimal integration with the physical layer, via our header portfolio with PCB layout simulation.

PHY-to-PHY Channel Analysis
- Component Limit Specification
- Complete Link Performance
- TEapp

Advanced Simulation Capabilities
- RF Simulation
- PCB Layout

One-stop-Shop for Connectors
- Complete portfolio of terminals, connectors and headers for all connection types
TE Connectivity
DIFFERENTIAL CONNECTOR SYSTEMS

MATEnet
Miniaturized automotive ethernet connector system
MATEnet is our modular and scalable miniaturized data connector system for automotive Ethernet. It can transmit up to 1 Gbps according to IEEE 100BASE-T1 and 1000BASE-T1 standards, and up to 4 Gbps with alternative technologies. Based on TE’s proven NanoMQS terminals, it offers true automotive robustness and is compatible with both unshielded Twisted Pair (UTP) and Shielded Twisted Pair (STP) variants.

HSD / HSL
Fully shielded connector system supporting up to 6 Gbps and 1 Gbps respectively
Our portfolio of fully shielded HSD and HSL connector systems supports different wire types and sizes. Compatible with LVDS, Ethernet and USB protocols, it features a full range of headers and connectors for unsealed and sealed applications. Our HSD and HSL products have been designed specifically for automated manufacturing and benefit from TE’s truly global manufacturing footprint.
TE Connectivity
DIFFERENTIAL
CONNECTOR SYSTEMS

Mult-gig Ethernet Connectors
TE Connectivity’s new fully shielded twisted pair connector system supports data transmission up to 12 Gbps. It is designed to meet the requirements of the current and next generation ethernet applications, transmitting uncompressed data for 4k displays, radar/lidar, high-resolution camera and safety applications.
TE Connectivity
COAXIAL
CONNECTOR SYSTEMS

MATE-AX Connector System
Miniaturized coaxial connector systems for radio frequency signals supporting up to 15 GHz
TE’s MATE-AX miniaturized coaxial connector system provides advanced automotive data transmission performance, supporting, as standard, up to 9 GHz or up to 15 GHz with optimized designs. Offering a higher packaging density, MATE-AX terminals can support up to 75% reduction in PCB footprint and by using existing wire types, it enables flexible integration into existing coaxial architecture. The MATE-AX connector system features an extensive portfolio offering a wide range of connector types and sizes to support all types of RF-based applications.

FAKRA Connector System
Automated coaxial connection system for radio frequency analog/digital signals supporting up to 6 GHz
Our extensive FAKRA connector system portfolio features an extensive range of cable assemblies, terminals and housings for use in the many various automotive RF based applications. This includes 14 key codes with sealed, unsealed, 180° and 90° orientation variants. Our FAKRA products have been designed specifically for automated manufacturing and benefit from TE’s truly global manufacturing footprint.
TE Connectivity
Data Connectivity Portfolio: MOST
CONNECTOR SYSTEM

Optical connectors supporting MOST (Media Oriented System Transport) protocols 25/150 Mbps

We offer a complete range of connectors supporting MOST 25 and MOST 150 protocols including PCB and harness connectors, cable assemblies and processing equipment. The portfolio is based on 1000 µm polymere optical fiber (POF) supporting data speeds of 25 Mbps and 150 Mbps.
TE Connectivity
Data Connectivity Portfolio:
USB TYPE-C

As the next-generation solution for current and future USB applications, our USB Type-C connectors are designed to an industry standard that provides a sleek, slim design small enough for handheld devices and robust enough for industrial applications. This connector supports a variety of different protocols, and with the use of adapters, it is backwards compatible to HDMI, VGA, DisplayPort, and other types of connections from the single USB Type-C port. We provide a distinctive electromagnetic interference (EMI) design on the back of the receptacle shell to help eliminate unwanted EMI leakage, as well as enhanced board retention features.
TE Connectivity
Cable Assemblies

TE produces highly reliable cable assemblies for coaxial, differential and optical data connectivity technologies. We offer research and development capabilities, rapid prototyping and samples, as well as manufacturing facilities. The cables include over-molding technology, semi and fully-automatic manufacturing processes testing equipment as well as handling of high and low volume production.

TE Connectivity
Application Tooling

Data connectivity applications based on TE's MATE-AX connector systems require proper wire termination to deliver optimum performance. TE's AMP-O-LECTRIC GII Terminator is therefore engineered with precision crimp height adjustment; variable speed, split-cycle operation; and quality monitoring features.

Visit TE.com to learn more about how TE's GII Terminator is engineered with advanced features to meet the needs of data connectivity applications and to enhance your productivity.

AMP-O-LECTRIC GII Terminator
TE Connectivity
HIRSCHMANN MOBILITY
WIRELESS DATA CONNECTIVITY

Data Network Solutions
HIRSCHMANN MOBILITY antenna systems for all types of mobile communication within and outside the vehicle including 4G/5G, Bluetooth and WLAN. Typical applications range from cellular telephony, cellular data transfer, WLAN hot spots, consumer device pairing, keyless entry and remote parking.

Infotainment Solutions
Wide range of antenna and tuner systems for multiple installation spaces. This includes film antennas, rooftop antennas, integrated antennas and amplifiers. Separate radio cards and remote tuner modules enable simplified head unit architectures, lower number of head unit variants and homologation costs.

Automated Driving Solutions
TE provides a range of V2X products to support automated driving and increase traffic safety. These include:
- fully functional V2X communication units that support DSRC and C-V2X standards, that can be connected over Ethernet and CAN;
- suitable antennas for 5.9 GHz and GNSS for ECU connection as well as compensators for signal attenuation.

Our wireless connectivity solutions offer high-performance signal reception and transmission in vehicles. We provide standard and customized antenna systems as well as radio tuner systems for all common global standards. Together with our wired connector portfolio we can offer a “one-stop-shop” for data connectivity components along the entire signal chain. That enables us to provide customized end-to-end data connectivity solutions based on optimized and compatible technologies to provide the highest possible signal quality and real-time data.