

DRIVING THE DATA-FUELED FUTURE

End-to-End Data Connectivity Solutions
for the Automotive Industry

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.

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 25 Gbps.



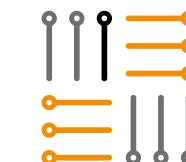
Robustness and Reliability

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.

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.

Products	Media	Bandwidth	Protocols	Speed	Example Applications
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	3 Gbps (6 Gbps dual lane)	• Dashboard/ Touch Screens • HD Screens • USB Connections
Mult-gig Ethernet Connectors 	Twisted Pair Parallel Pair	20 GHz	SerDes: GMSL2/3, FPD-Link III/IV, APIX3, MIPI Multi-Gig Ethernet PCIe	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 Parallel 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.

Antenna Amplification PHY/IC



PHY-to-PHY Channel Analysis

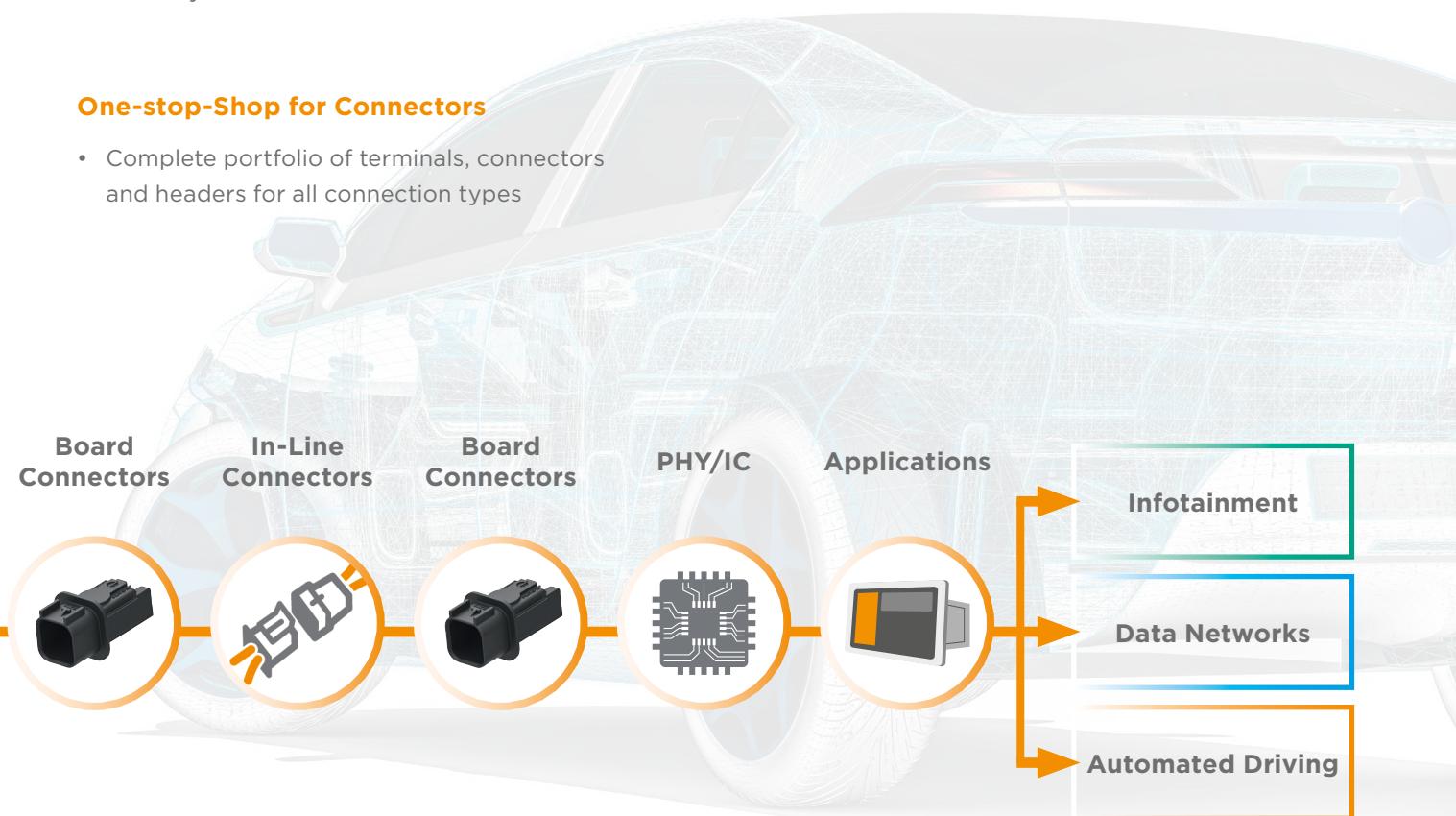
- Component Limit Specification
- Complete Link Performance
- TEapp

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 1Gbps 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.



5 port frame



Cable assembly



1 port water proof frame



In-line coupler

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.



1 position 90 degree header



1 position 180 degree header



180 degree sealed female plug



90 degree female plug plus 2 MQS positions

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.



1 position header



1 position plug



2 position header



4 position header

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 15GHz 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.



1 position header



1 position female



4 position header



4 position female

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.



2 position vertical header



90 degree female



180 degree female sealed



180 degree female dual

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.



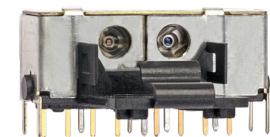
2 position cable assembly



MOST 150 fully-shielded pigtail



Semi-shielded pigtail



2 piece flexible micro-pigtail

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.



90 degree header



180 degree header



90 degree plug



180 degree plug



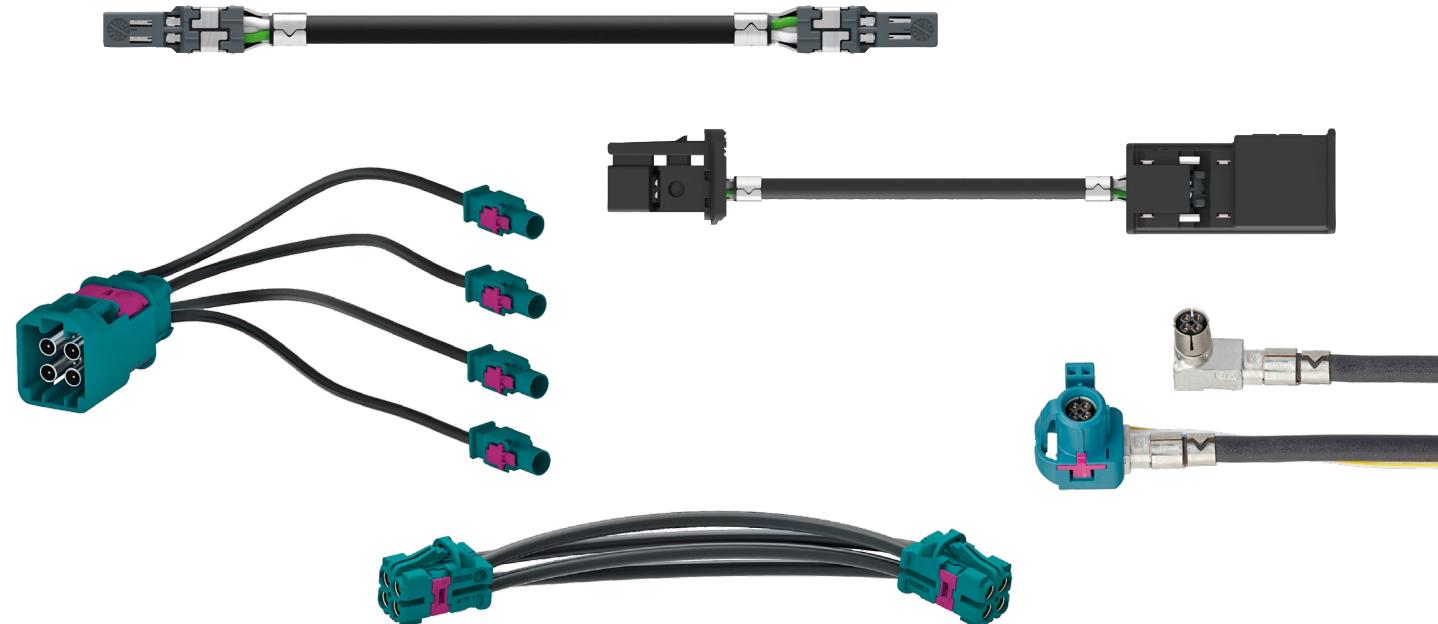
180 degree inline

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, roof-top 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.



Cellular antenna



Roof-top sharkfin antenna



Cellular film antenna



Bluetooth/ WLAN antenna



Remote tuner module



Broadcast film antenna



Antenna amplifier



Rooftop rod antenna



V2X antenna



GNSS antenna

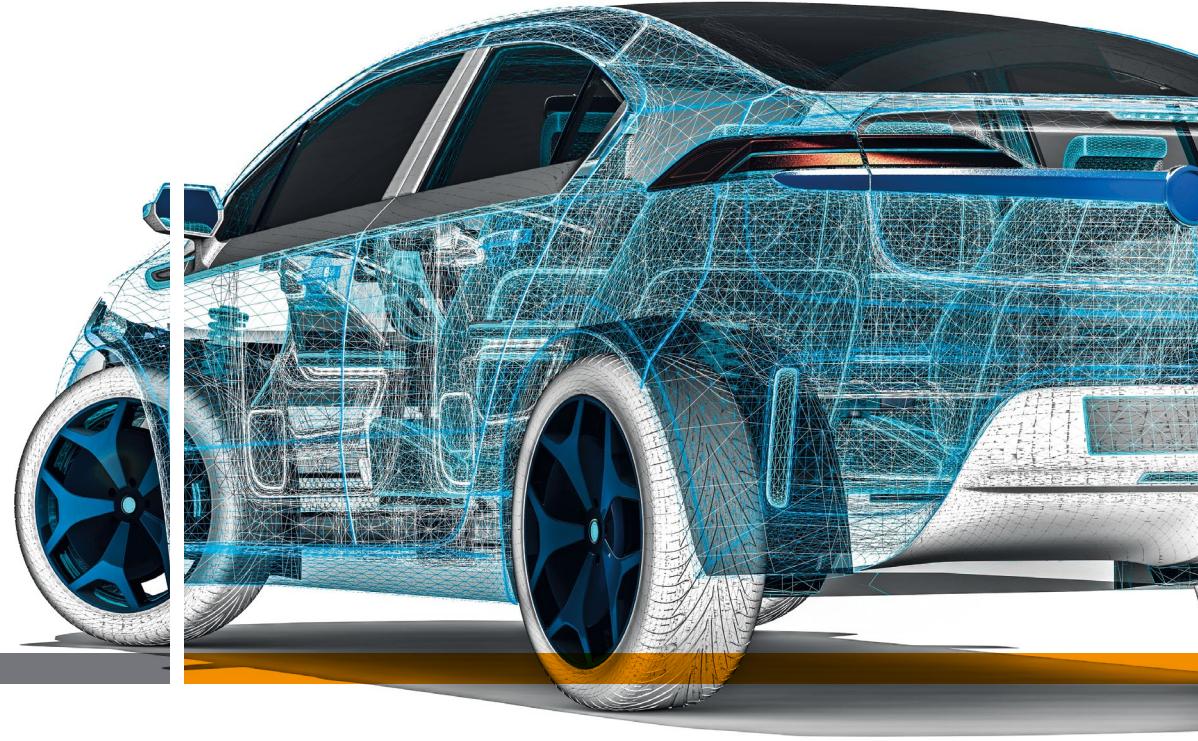


V2X ECU (DSRC/ C-V2X)



V2X compensator

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