

Making Room for Rugged, Reliable Connected Applications >

Electronics are expected to make up 50% of the cost of a new car by 2030 as automakers race to deliver the latest functionality. Learn how engineers can not only simultaneously design in more features with less available space but do so with components built to withstand harsh environments.

When today's customers come to a car dealership, they don't just kick the tires and ask about mileage and price. Instead, they want to know if the car can keep them in their lane, brake in an emergency or sense a pedestrian on a dark, rainy night. Does it provide passengers with personalized entertainment systems? Can the suspension be adjusted with the touch of a button?



In the intensely competitive automotive world, manufacturers and dealers are under pressure to deliver more and more software-driven capabilities, and it's changing the nature of the industry. Vehicles are no longer just vehicles — they're mobile data centers running a slew of customized apps. By 2030, electronics are expected to make up 50% of the cost of a new car, up from 35% in 2010.

Growing Challenges

Thanks to design advancements like zonal architecture, this new software-defined auto ecosystem is destined to expand further as algorithms assume more functions and electric vehicles gain popularity. But it's already putting a strain on manufacturers for several reasons.

One problem is that automakers are running out of room to install more connections. That means they must pick and choose which popular features to include, inevitably disappointing some customers and losing market share.

They must also ensure the reliability of sensitive electronic equipment in harsh interior and exterior environments. Within the chassis, temperatures of over 100 degrees combined with strong, frequent vibrations can loosen connections. Moisture seeping in from the outside air can cause condensation inside connectors, while incoming dirt and grime erode the casings — a situation that's particularly prevalent in trucks and tractors. Even before a vehicle hits the road, water may be introduced during manufacturing, and assembly errors can cause contacts to back out during operation.

The more software and hardware connections a vehicle contains, the greater the chance for problems. And as driver assistance systems move closer to autonomy, the stakes are growing higher. Preventing accidents — and potentially saving lives — requires enormous amounts of data to be reliably transferred in near-real time.

A New Ecosystem of Solutions

Recent innovations in electronics are helping manufacturers solve these complex problems and pave the way for more sophisticated automation in the future. For example, engineers have developed [miniaturized connectors](#) for power steering, cameras, sensors, braking systems, exterior lighting and mirrors. These various technology packages contain smaller terminals, pins and wires, allowing designers to fit more circuits into tight areas. Manufacturers gain greater than 25% more space than they would have with traditional connectors, allowing them to add more electronic features to vehicles while reducing cost and

weight. Designers can also conserve space by arranging wires in [stackable connection systems](#), grouping components for unsealed applications in flexible configurations.

In addition, mechanical engineers have designed in various features to support connector durability and reliability, such as connector position assurance (CPA), independent secondary lock (ISL), terminal position assurance (TPA) and audible click upon mating. These mechanical technologies make the delicate work of hand assembly easier and less prone to operator error. A connector that produces a distinct audible click ensures secure mating when the vehicle is in motion, even when vibration levels are high. It also makes servicing easier, allowing technicians to avoid damaging other components as they work.

Designers have also reduced the size of sealed connectors used for safety equipment like seatbelts and airbags, as well as powertrain applications like emission controls and fuel injection. A new connector system with smaller, space-saving terminals uses ruggedized [sealed crimp technology](#) to protect these vital connections from vibrations, high heat, moisture, dust and dirt, ensuring reliable performance.

Unique [miniaturized sealed systems](#) are available for applications up to 14.0A with 16 to 24 AWG wire, delivering more power safely over smaller wires. Ideal for trucks and off-road vehicles traveling in wet conditions, these systems are rugged and reliable yet more compact than other high-gauge sealed connectors, allowing manufacturers to save money and conserve space.

[Miniaturized coaxial cables](#) can reliably handle the high-speed data requirements of advanced automated applications, like 360-degree camera systems. In addition to carrying high-frequency signals with low losses, this miniaturized connector system can be configured in many different ways, allowing designers to save up to 48% of space on the front of a printed circuit board.

Rugged applications can be subject to shock, vibration or rough handling that can dislodge terminals and cause signal interference. Secure mating and PCB retention is required for high-vibration applications. Molex offers miniaturized connector solutions with superior electrical contact reliability and solutions that maintain performance in high-heat applications such as lighting systems, with ambient temperatures ranging from -40°C to +125°C.

A Trusted Supplier of Rugged and Reliable Miniaturized Connectors

As software, zonal architecture and hardware play a more significant role in vehicle operations, manufacturers who work closely with suppliers can discover the latest innovations and jointly develop solutions to fit their specific needs. With years of expertise across the spectrum of connectors and a global network of partners, Molex can collaborate with auto engineers from the design phase through testing and delivery, ensuring that connection systems meet cost and space requirements while providing reliable transmission and durability, even in the toughest conditions. Learn more about [Molex miniaturization capabilities](#) for automotive technology.

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