Connecting Automotive Infotainment Systems

Modern automotive infotainment systems are designed to make driving safer, more convenient, and more enjoyable for both drivers and passengers. Automation, AI, IoT, and driverless technologies play significant roles in shaping these advanced systems, delivering a more integrated and personalized driving experience. These innovations automate tasks once handled manually, enhancing both comfort and functionality. To support these capabilities, compact, high-speed connector solutions are needed—ones that offer high bandwidth, low latency, simplified assembly, and lower system cost.

APPLICATIONS

The automotive infotainment market includes a variety of system types such as audio units, display units, heads-up displays, navigation systems, and communication interfaces. Some key functions supported by modern infotainment systems include:

- Smartphone integration
- Voice recognition
- Rear-seat entertainment
- Advanced navigation
- Wireless charging
- Driver assistance systems (ADAS)
- Digital monitoring systems (DMS)

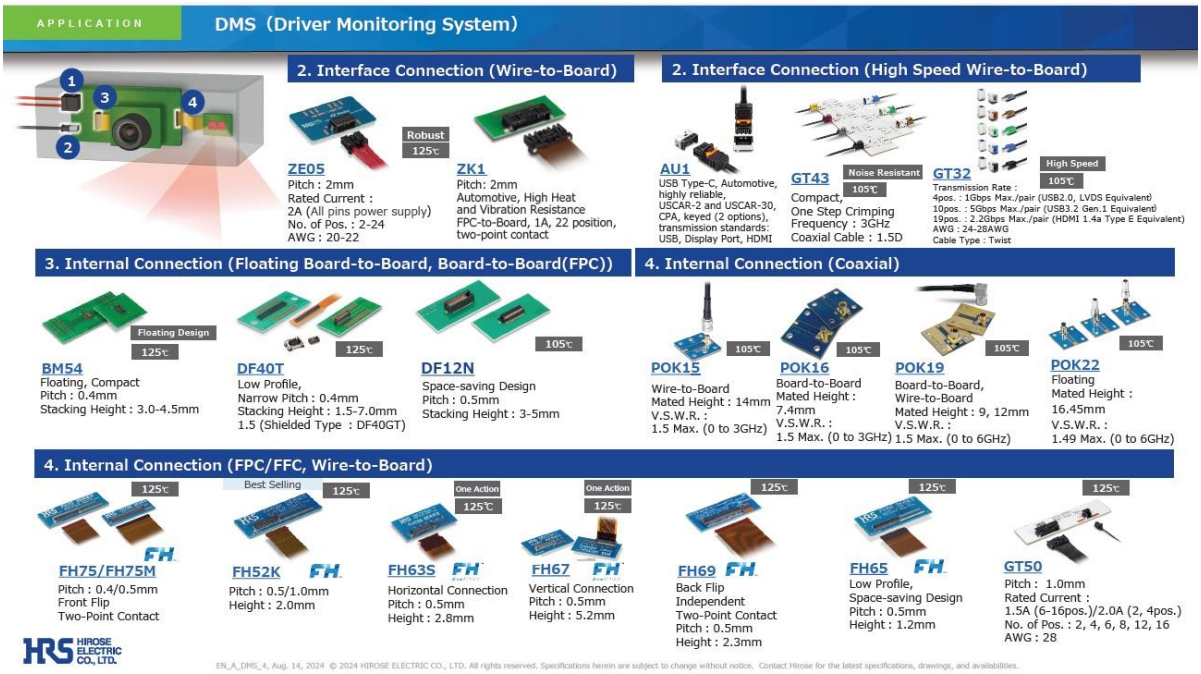


Figure 1 Caption: *Automotive display connectivity examples*

CHALLENGE: FORM, FIT, AND FUNCTION

Today's vehicles rely on a growing number of sensors, cameras, LiDAR, and other technologies to safely navigate and interact with their environment. From backup cameras to heads-up displays, Infotainment systems integrate with these technologies to deliver a seamless driver experience. With added functionality comes limited space, making connector solutions that offer miniaturization, ease of assembly, and high-speed or power support critical to design success. Shielded connectors are also key for reducing EMI and maintaining high-speed performance.

Figure 2 Caption: *Automotive cameras connectivity examples*

Challenge: Heat

Automotive environments are harsh—exposing connectors to extreme temperatures, vibration, and limited airflow. High-density electronics in tight spaces generate hotspots, which can impact reliability. With limited room for heat sinks or airflow, connectors rated for 125°C operation are preferred in many infotainment systems to ensure long-term durability.

Challenge: Cost

OEMs aim to reduce cost, size, and weight by minimizing part counts. Multi-functional (hybrid) connectors that combine signal and power in one compact unit help achieve this—lowering cost and simplifying designs.

Challenge: USCAR Standards

Keeping up with evolving automotive technology isn't easy—even for standards bodies. USCAR-2 remains the primary standard for automotive electrical connector systems, covering performance testing for low-voltage (0 to 20 VDC) and coaxial connectors throughout development, production, and field analysis. USCAR-17 addresses RF connectors operating between 70 MHz and 3 GHz, while the newer USCAR-49 covers miniature coaxial connectors from DC to 9 GHz. Currently, no USCAR standard exists for connectors operating above 9 GHz, leaving Vehicle-to-Everything (V2X) communication outside formal guidelines.

AUTOMOTIVE INFOTAINMENT CONNECTOR TYPES

Infotainment systems use several types of connectors depending on function, cost, and space constraints:

Wire-to-board connectors

Commonly used to link wires directly to a printed circuit board (PCB), wire-to-board connectors are easy to install and provide reliable connections. Many designs include Connector Position Assurance (CPA) or Terminal Position Assurance (TPA) to ensure secure, fully seated terminals—especially in high-vibration environments.

Hirose connectors often eliminate the need for CPA or TPA thanks to their inherently strong terminal retention and a secure, audible, and tactile feel. This design approach has been validated and accepted by several global automotive manufacturers.

- **Benefits**: Flexible PCB and component placement
- **Drawbacks**: Higher cost due to added wire harness

Board-to-Board Connectors

Board-to-board connectors link two printed circuit boards within an infotainment system. They support high-density signal transmission, power delivery, and high-speed data—making them ideal for advanced infotainment designs.

- **Benefits**: Simplifies design with one connector; lowers cost by eliminating wire harness
- **Drawbacks**: Requires PCBs to be positioned close together. Over-constraint often limits designs to one mating pair—unless using a floating connector like Hirose's DF40F or FX23.

Waterproof interface connectors:

Used in infotainment applications that require protection from dust, moisture, and frequent handling. These connectors come in a range of sizes and pin counts to support diverse system needs.

- **Benefits**: Waterproof and dustproof, high mating cycle, durable under roughly handling
- **Drawbacks**: Higher cost due to specialized material and construction

FFC/FPC connectors:

Ideal for compact spaces like dashboard displays, these connectors link flat flexible cables (FFC) or flexible printed circuits (FPC) within infotainment systems.

- **Benefits**: Compact; cost-effective
- **Drawbacks**: Not suited for rough handling, can be less durable than wire to board, limited shielding options with FPC.

AUTOMOTIVE INFOTAINMENT CONNECTOR SOLUTIONS

Floating Contact System

Wire-to-board connectors were once the go-to solution for infotainment systems—but they can consume more space and complicate assembly. Newer board-to-board connectors that feature a floating contact system simplify assembly and reduce labor costs, all while offering space savings.

Floating contacts absorb alignment errors and vibration for more reliable operation. For example, the FX23 Series offers a ±0.6 mm floating range in both the X- and Y-axes, along with ±0.30 mm tolerance in the Z direction. This helps prevent misalignment during assembly. The spring portion of the terminal absorbs assembly misalignment, reducing the need for rework during production. This makes floating contact systems ideal for densely populated infotainment controller boards requiring multiple connections. They also enable the use of more than one connector pair without risking misalignment issues.

The floating mechanism also reduces stress on solder joints, helping prevent cracking and enhancing long-term durability.

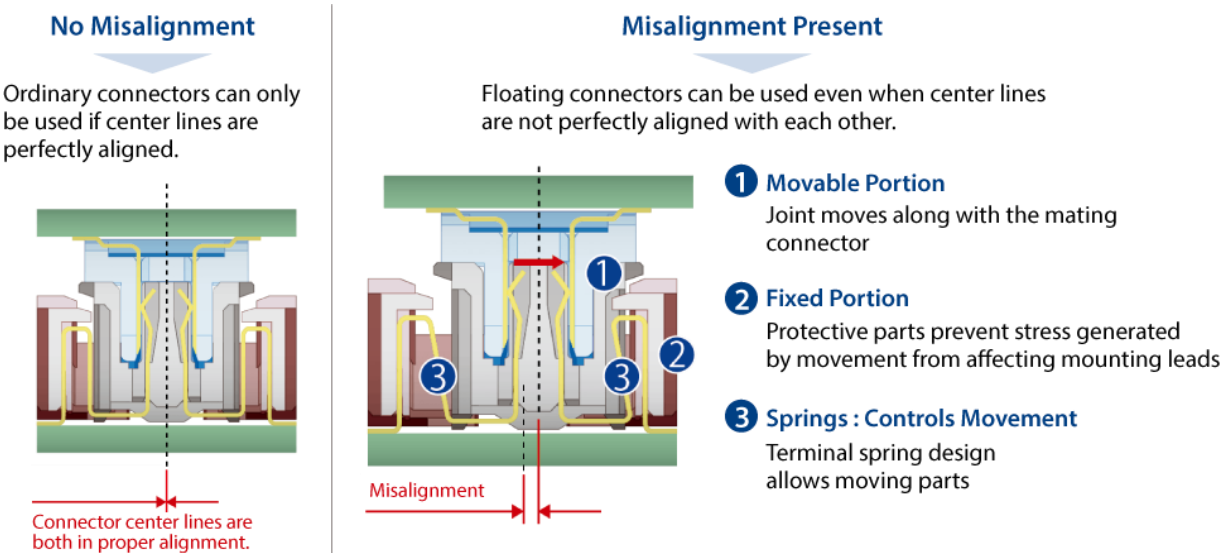


Figure 3 Caption: *The floating design offers a degree of "play" between the contacts during mating and allows the connector to absorb alignment errors and simplify assembly*

When board-to-board connectors combine high-speed capabilities, strong signal integrity, and high-temperature resistance—all within a compact footprint—they become ideal for automotive infotainment systems. The FX23 Series checks all those boxes and more.

As a hybrid connector, the FX23 supports both signal and power transfer in one compact solution. With 0.5A per pin for signal and 3A per pin for power, it reduces component count and simplifies design—while maintaining performance and reliability.

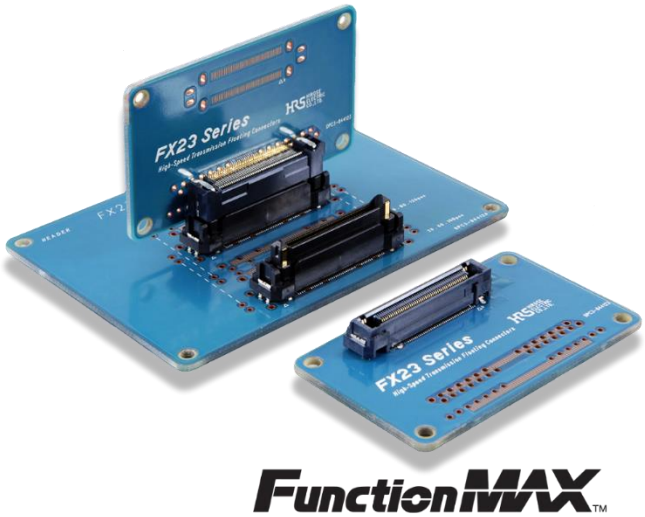
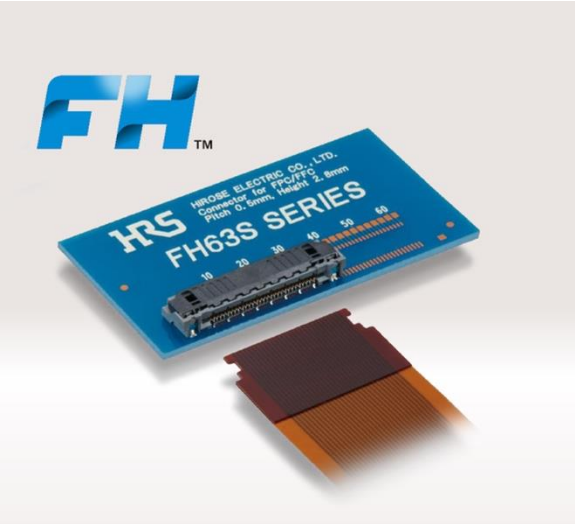


Figure 4 Caption: *Hirose FX23 Series floating board-to-board connector is commonly used in automotive ADAS devices like cameras, radar, and sensor systems*

Zero Insertion Force

Infotainment designers choose FPC/FFC connectors primarily to reduce cost and save PCB space. Zero insertion force (ZIF) connectors improve on traditional low insertion force (LIF) designs by making mating easier and more secure. These connectors come with the latch closed, and the mating operation is completed without the need to open the latch.



For example, the One Action FH63S Series offers a great option for ease of mating in space-constrained infotainment display designs. Tight spaces provide no access to reach into the actuator and complete the mating procedure using flip lock ZIF connectors. The One Action lock enables mating in tight spaces without opening the latch.

Figure 5 Caption: *Within instrument cluster and infotainment systems, the FH63S supports specific demands like high temperatures, vibration requirements and tight space requirements.*

This design is ideal for compact infotainment displays, where access to the latch may be restricted. One Action connectors also boost efficiency—reducing mating time from several seconds to just one or less. This makes them a smart solution for high-volume production environments and robotic assembly.

Finally, the contactless mating process of the One Action connector lends itself to the possibility of robotic assembly. The robot can grab the flex and insert it into the connector without the need for human hands. Even in manual operation, no special training is required—making the process simple and efficient.

Displays, which play a major role in this process, are becoming larger and higher in resolution, driving the need for high-speed, high-capacity video signal and data transmission within vehicles.

As in-vehicle displays grow in size and resolution, demand for fast, reliable data transmission rises. Technologies like USB are becoming more common in automotive infotainment, making connector speed, size, and usability more critical than ever.

USB Connectors

As infotainment displays become larger and more advanced, the need for high-speed, high-capacity data transmission is growing. USB—especially USB Type-C—is now a go-to interface for automotive applications, enabling fast charging and seamless connectivity for smartphones, gaming devices, and more.

Hirose's AU1 Series supports USB, DisplayPort, and HDMI, offering flexibility across a range of in-vehicle systems. Its reinforced shell and housing meet USCAR-2 and USCAR-30 requirements for vibration and heat resistance. With a built-in Connector Position Assurance (CPA) feature, the AU1 Series delivers strong, reliable signal transmission and simplifies board design in automotive environments.

Figure 6 Caption: *Note: While the AU1 is not a USCAR interface, it meets many key automotive requirements.*

CONCLUSION

Automotive infotainment systems continue to evolve—adding more features and functions to create a connected, personalized driving experience. These systems rely on a range of connectors to meet specific requirements like speed, power, size, and durability. Selecting the right connector depends on key factors such as data rate, current capacity, available space, and operating conditions. As vehicles become more complex, connector solutions must keep pace—offering smaller footprints, higher reliability, and easier assembly to support future innovation in automotive design.

https://www.hirose.com/en/product/industry/Infotainment-For-Automotive