



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:

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



Figure 1 Caption: Automotive display connectivity examples **CHALLENGE: FORM, FIT, & 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



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 -even for standards committees. 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.



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 incorporate Connector Position Assurance (CPA) or Independent Secondary Lock

In some markets and applications, Hirose's robust connector designs have eliminated the need for Connector Position Assurance (CPA) or Independent Secondary Lock (ISL)

terminals—especially in high-vibration environments.

(ISL) mechanisms to ensure secure, fully seated

mechanisms. These connectors feature strong terminal retention with a secure, audible, & tactile mating feel—a design approach validated & 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 datamaking 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

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. **Depending on** configuration, ±1.2 mm floating in the X- and Y-axes is also available. 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.

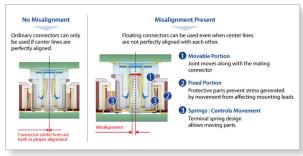


Figure 3 Caption: The floating design offers a degree of "play" between the contacts during mating and allows the connector to absorb alignment errors and simplify assembly

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

transfer in one compact solution. With 0.5A per pin for signal and 3A per pin for power, it reduces component count & simplifies design—while maintaining performance and reliability. Figure 4 Caption: Hirose FX23 Series floating board-to-board connector

FX23 supports both signal and power

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

Function **MAX**.

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. As automotive displays grow larger and higher in resolution, infotainment systems require faster, more reliable data transmission to handle high-capacity video and signal processing. Technologies such as USB are now integral to meeting these performance demands—making connector

speed, size, and usability more critical than ever.

the need for high-speed, high-capacity data transmission is growing. USB—especially USB Type-C—is now a go-to

USB Connectors

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

As infotainment displays become larger and more advanced,

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

housing meet USCAR-2 & USCAR-30

meets many key automotive requirements.



information on Automotive Connectors

construction