

CONNECTING THE FUTURE

Future Forward



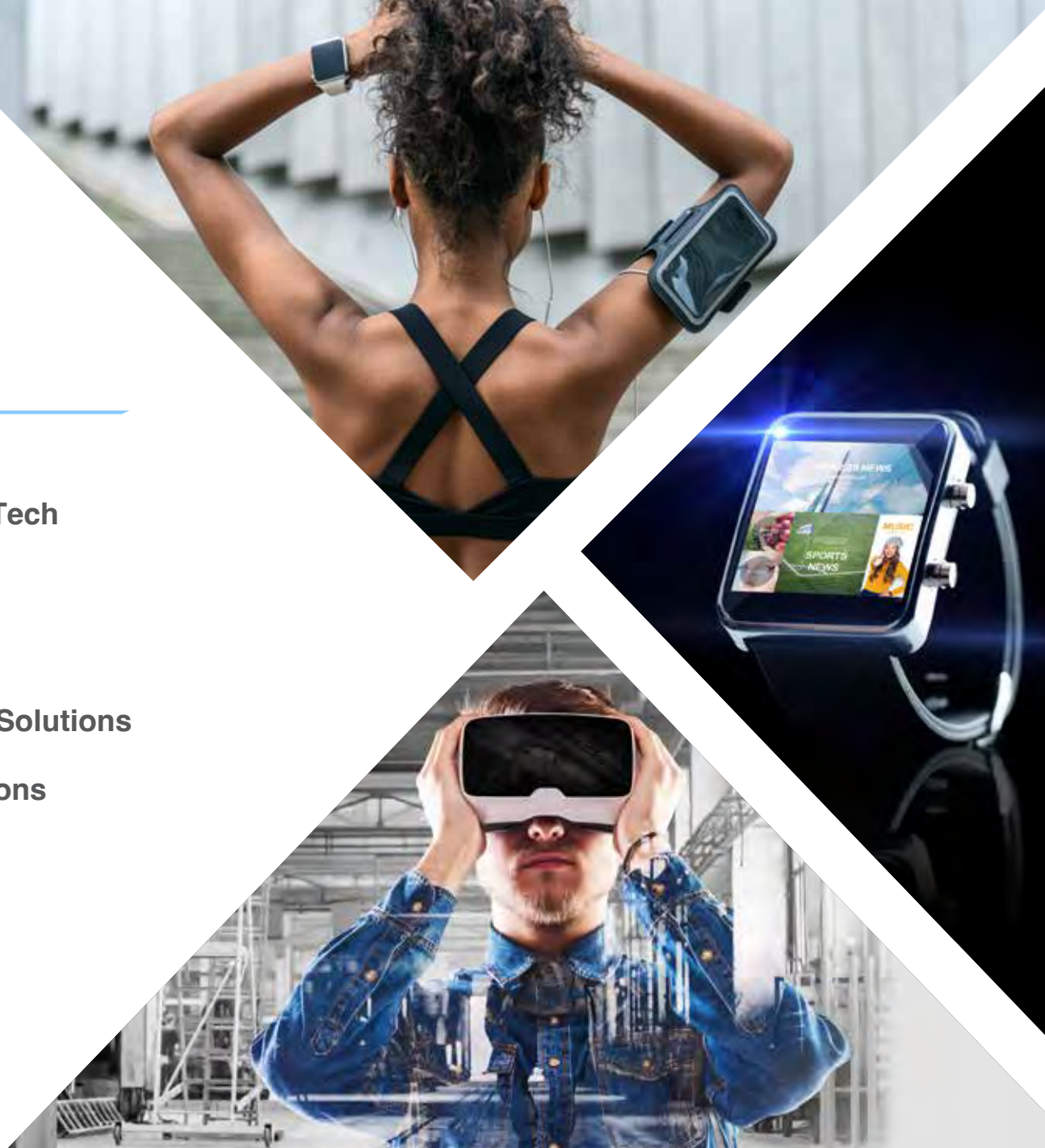
Wearable Technology with Hirose:
Innovative Connector Solutions



HIROSE ELECTRIC AMERICAS

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Plugging into Fashion:

Wearable Technology is Taking Over

The shift from analog to digital devices has **revolutionized nearly every aspect of our daily lives**, including clothing and lifestyle accessories. Incorporating digital technologies, sensors, and wireless connectivity, wearable devices enhance user experiences with improved monitoring, real-time data collection, safety, and other advanced functionalities. From the everyday utility of smartwatches and fitness trackers to the **life-saving capabilities** of heart monitors and the **innovative integration** in smart clothing, wearable devices are a seamless blend of technology and fashion, addressing diverse application needs.

Tech's continuous advancements suggest that wearables will become even more powerful, versatile, and ingrained in our daily (and nightly) routines. The market for wearable devices, already expanding beyond **consumer and healthcare sectors**, is set to grow into industrial, military, and other fields.

According to projections, the
**Wearable Technology
Market Growth**

\$138 billion in 2022 → \$491 billion in 2032*

Where are you Wearing Wearables?

Technology advances have made wearable devices smaller and more efficient, popular for their convenience and broad application use, including:

- **Integration with Smartphones and IoT:** Smartwatches, smart rings, and smart clothing are increasingly integrating with the IoT ecosystem, providing real-time data and seamless connectivity.
- **Healthcare:** These devices monitor patient health, provide early warnings for medical conditions, support telemedicine, and more.
- **Enterprise and Industrial Applications:** Devices revolutionize employee productivity tracking, safety monitoring, and logistics management.
- **Gaming:** Augmented reality glasses, virtual reality headsets, and smart gaming controllers enhance gaming experiences with immersive technology.
- **Military and Law Enforcement:** Wearable technology, including body cameras and GPS systems, biometric devices, and health monitoring tools, is becoming integral in security and defense.



Balancing SWaP in Functional Design



Designers and engineers must skillfully navigate trade-offs between size, weight, & power (SWaP) and the desired functionality and performance, striving to achieve the optimal balance for each specific application.

Size:

Weight:

(High) Power:

High-Frequency Signal Integrity:

Balancing space, performance, and assembly needs in connectors becomes more challenging as wearable designs grow in complexity.

- **Size:** The push for miniaturization challenges traditional design principles, demanding innovative approaches to integrate multiple functionalities
- **Weight:** Achieving lighter devices is crucial in increasing user comfort and portability yet maintaining adequate structural integrity and durability.
- **(High) Power:** Supports new integrated features such as high-resolution displays and advanced sensors that optimize energy usage and minimize power consumption.
- **High-Frequency Signal Integrity:** Essential for Bluetooth, Wi-Fi, and 5G connectivity, maintaining signal integrity (SI) to prevent interference and noise.

Hirose's ultra-small, low-profile connectors, armed with high-speed transmission technology, address the design challenges of wearables, offering design flexibility.

From **USB Type-C** interfaces for rapid data transfer to high-power connectors for enhanced battery performance, our solutions prioritize function and form, fitting sleek wearable designs.

Connector selection in wearable designs varies based on the specific application and requirements. **Hirose offers diverse connector solutions tailored to meet your application requirements.**

EXPLORE OUR RESOURCES:

Download guides & product recommendations to enhance your engineering decisions.

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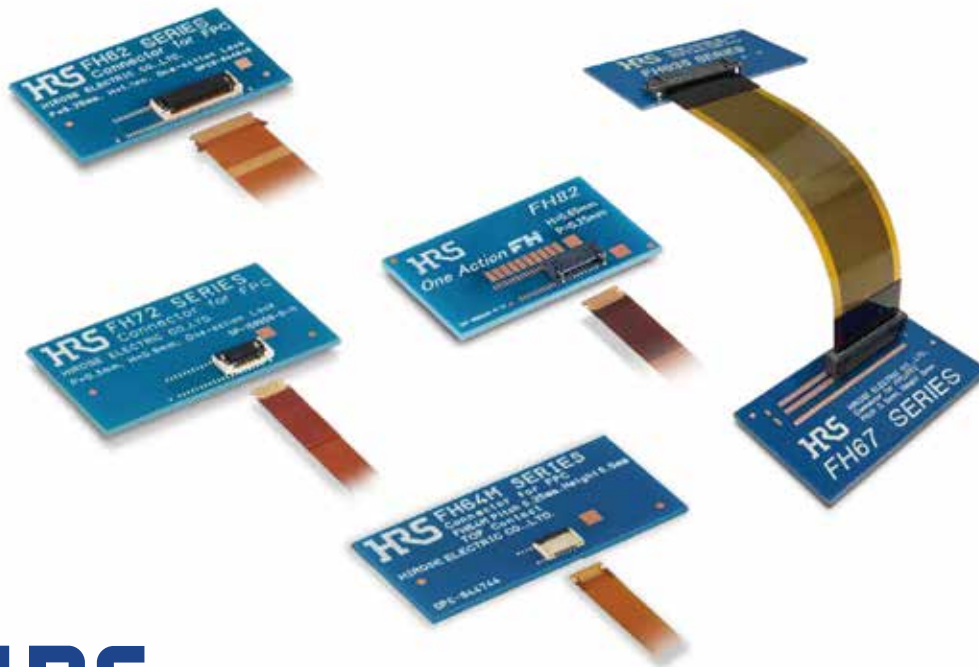


FPC/FFC Technologies

The popularity of FPC/FFC technology is on the rise due to their compact size and affordability.

High-speed FPC/FFC connectors **simplify cable management, reduce assembly time, and cut costs.** Using FPCs to connect USB to PCBs offers design flexibility, as the USB can be placed anywhere within the design of the end product.

OneAction FH™



Zero insertion force (ZIF)

- Low-profile ZIF connectors enable the development of thinner end-devices while simplifying installation
- The **FH64MA Series**, with a 0.25mm pitch, 0.5 mm height, and a width of 3.15 mm, is the world's lowest-profile ZIF connector.
- Hirose offers a wide range of **ZIF connectors** featuring super low profiles, high-density, and more.

One Action ZIF

- One Action ZIF connectors, such as the **FH62/FH72 Series**, allows for contactless mating in wearable designs.
- The **One Action connectors** greatly simplify the mating process, reducing the average mating time to 1 second or less, saving time and money.

Wearable devices are increasingly adopting the next-gen USB Type-C as their standard interface.

Its smaller form factor and reversible design have made Micro-USB and USB-C connectors, like the USB Type-C, popular choices for charging and data transfer.

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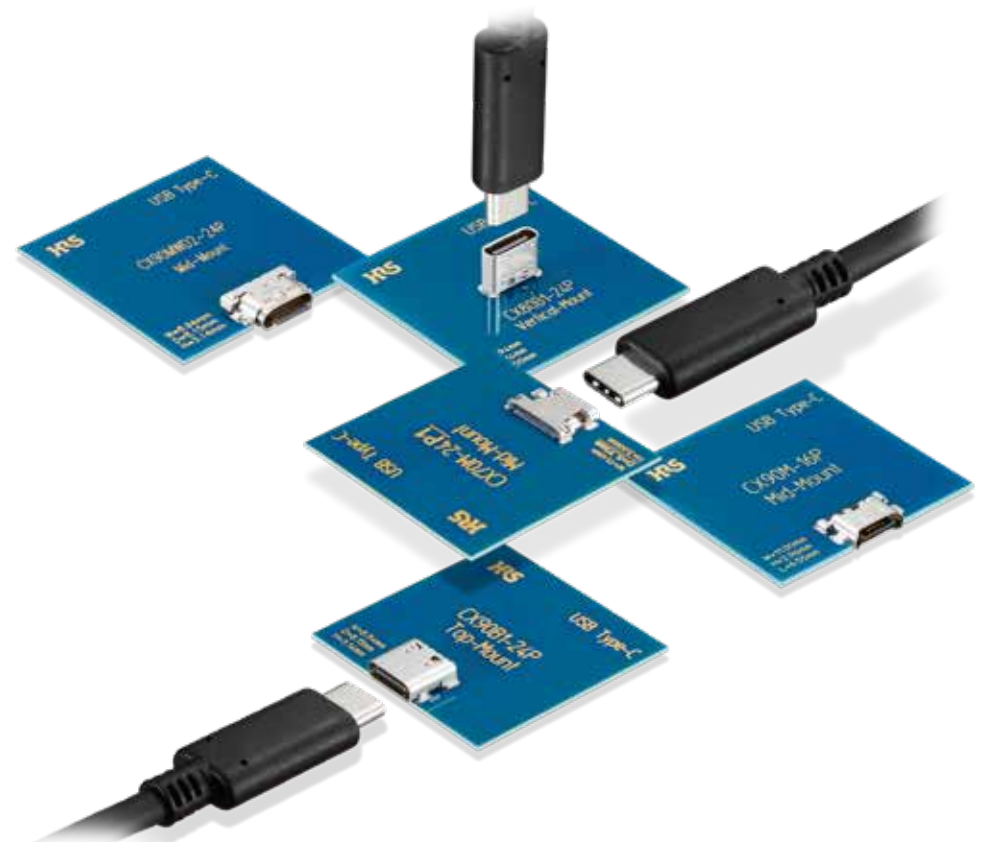
The expansive miniature CX Series offers a wide range of variations, including hybrid (power and signal), waterproof (IPx8), high-speed (10 Gbps), high-current (6A), and more.

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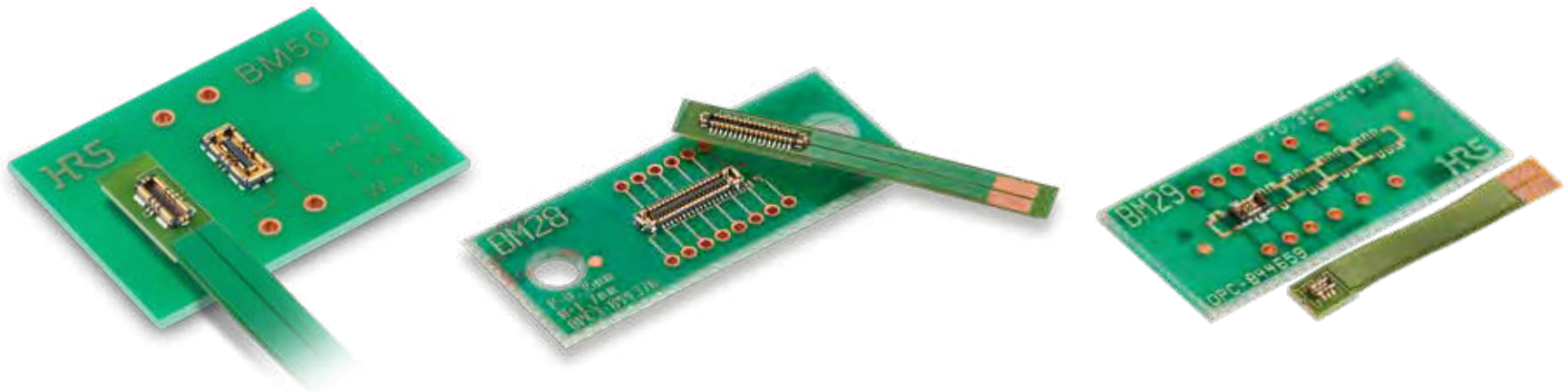


Space-Saving Hybrid Power and Signal

Using separate connectors for power, data, and signal connections can lead to a complex web of cables and connectors.

Hybrid connectors offer both power and signal in one connector, reducing the number of components required on the PCB. This approach offers **design flexibility and miniaturization, streamlining manufacturing and assembly processes and lowering costs.**

- Miniature hybrid FPC connectors combine PCB space savings with high-power operation.
- The **BM50 Series** supports up to 15A and reduces the PCB mounting space by 40%, contributing to a significant reduction of both the space used inside the device and the size of the customer's end products.
- The **BM50 Series** incorporates oversized solder pads and end metal structures, enabling effective power management and mechanical reinforcement within limited space in wearable designs. Hirose also offers ultra-slim hybrid versions, including the **BM28 Series** and the narrow **BM29 Series**.



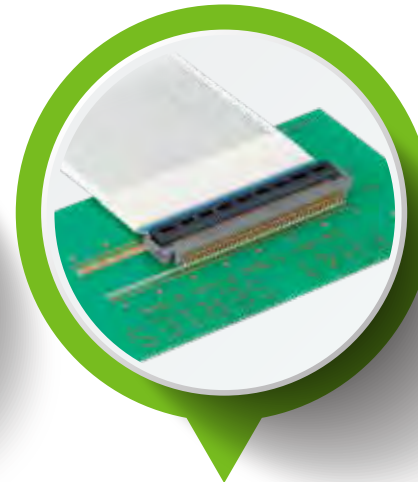
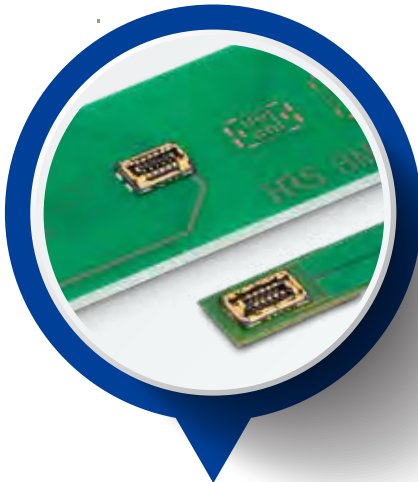
(BM28 = 5A, BM29 = 3A, BM50 = 15A)

Advanced Shielding for High-frequency Applications.

Integrating shielding in connectors mimics a traditional shield box effect, crucial for maintaining Signal Integrity (SI) in small form factors.

Board-to-Board

- The **BM56G Series** features a double-shielded structure with 360-degree metal coverage around both the receptacle and header. This design supports multiple RF & digital signals with excellent SI performance up to 12GHz.
- The **BM56G Series**, with an industry-leading width of only 2.2 mm, provides a size reduction of up to 71% compared to conventional designs.
- The **ultra-low-profile** connector can be strategically placed on top of a device's battery, maximizing space savings and offering greater design flexibility for smaller, lighter end-products. Other shielded solution include: **U.FL micro-coax** and **FH41**.



Hirose Value

Engineering Excellence in Wearable Technology

Coaxial Connectors

*Found in wearables with radio frequency (RF) components, such as GPS, Wi-Fi, or cellular connectivity

- The ultra-light **U.FL Series**, a de facto standard in the industry for micro coaxial connectors, ensures secure RF signal connections up to 18.0 GHz.
- The **X.FL Series** SMT coaxial connectors are lightweight, ultra-compact, and support frequencies up to 12 GHz.

FPC/FFC

- Shielded FPC/FFC connectors, like **FH41, FH46, FH48, and FH67**, offer horizontal and vertical orientations with enhanced shielding.



Did You Know?

Hirose offers a diverse selection of connectors tailored for today's wearable devices. From USB Type-C interfaces for fast data transfer to high-power connectors for superior battery performance, our solutions prioritize both form and function, fitting perfectly into modern wearable designs.



Engineering Excellence in Wearable Technology

Comprehensive Technical Support:

- Our dedicated technical teams specialize in high-speed design projects with a particular emphasis on mm-wave domain components, boards, and sub-system projects.

Signal Integrity Engineering:

- A specialized SI engineering group addresses the unique challenges of high-frequency designs and demanding form factors.
- Involved in performance modeling, especially for 5G radio applications, considering connectors, PCBs, and FPC cables collectively.

Subsystem Performance Optimization:

- Provides SI results for various component combinations, digital micro-board to FPC solutions, and environmental performance considerations.

Responsiveness to Customer Needs:

- A proactive approach to understanding and responding to unique customer requirements.

Tailored Solutions for Complex Challenges:

- Addresses complex challenges involving multiple radio paths, chip, and circuit trace radiation concerns, and both internal and external interference.

Commitment to Industry-Specific Knowledge:

- We engage in collaborative analysis & optimization of not only connector components but also related subsystem elements.



Conclusion



Empower your engineering journey

Choosing Hirose Electric as your connector partner means more than selecting a connector; **it's investing in a solution that addresses your design challenges and contributes to the success of your wearable device.**

Empower your engineering journey with Hirose, your **trusted partner** in wearable **connectivity solutions**. Contact a wearable design expert today to elevate your wearable device design.

[Want to Learn More? >](#)