TE connectivity

TREND PAPER

ENGINEERING WHAT'S NEXT

The Future of Appliance Electrical Architecture: A Connected Living Solutions Perspective

We are living in a smart world. In an era of digital transformation, new smart technologies are integrating into all areas of our lives and reshaping how we live and operate. It's creating smart cities. It's happening in smart homes. And to ensure a more sustainable and energy-efficient world in which every connection truly counts, it starts with smart appliances.

It's time to think smart. Electrical architecture that relies on machine learning and AI, connectivity via the Internet, and a range of sensors is driving the design of smart appliances that are more convenient, energy-efficient, and interconnected. The result is an increasing focus on ovens, refrigerators, washers, and HVAC systems that better facilitate cooking, cleaning, and establishing climate-controlled settings to enhance lifestyle management and realize energy savings.

Market forces are fueling the expansion and adoption of smart appliances. Urbanization around the world and the expansion of the middle class, particularly across Asia, have sparked smart appliance purchasing. Consumer interest in smart appliances that support lifestyle preferences is on the rise. This includes a desire for comfort and ease, energy-efficient consumption, and broader sustainability concerns aimed at securing the longevity of our planet.

Perhaps even more so, government regulations are dictating new standards for stricter energy efficiency and sustainability that smart appliances can help deliver. Various incentive programs have been introduced to either encourage manufacturers to upgrade standards or drive consumer purchasing (see box 1.0).

In the pages that follow, we'll look at the electrical architecture of smart appliances. We will provide a perspective on what is required to make these connected living solutions effective from a market, operational, and regulatory standpoint. We'll also focus our lens beyond key component products that meet specific functional needs to emphasize system solutions that meet broader smart objectives.

Box 1.0

In key markets around the world, government standards and incentive programs are encouraging manufacturers to pursue smart appliance opportunities while also driving consumer interest.

China

- Smart Home Appliance Certification is a national CCC standard for smart appliance interoperability and performance[1]
- China Energy Label (CEL) is a label for the energy consumption of a product; it is intended to encourage customers in China to opt for an energy-saving model when making purchasing decisions, thus promoting sales of energy-saving electrical appliances[2]

EU

- Ecodesign for Sustainable Products Regulation (ESPR) aims to enhance product sustainability and energy efficiency across the European Union, requiring appliances to be energy-efficient, and often demanding smart readiness for remote control, diagnostics, and updates[3]
- Initiatives like the Energy Efficiency Directive promote energy savings across homes, offering incentives for homeowners who choose renewable energy sources and appliances[4]

Japan

- The Japanese government has been actively promoting the adoption of smart technologies and energy-efficient appliances to reduce carbon emissions and improve sustainability[5]
- Japan's local governments offer rebates to encourage the replacement of old home appliances with new energy-efficient appliances to reduce energy consumption[6]

US

- The Inflation Reduction Act offered rebates and tax credits for some energy-efficient smart appliances; however, under the new Big Beautiful Bill, most of these rebates will expire in late 2025[7]
- Consumers can look to state programs for incentive programs[8]

CURRENT STANDARDS: WHERE WE ARE NOW

Before we look to the future of smart appliances, it's important to understand the greater appliance marketplace. Currently estimated to reach $994B by 2032, it is expected to grow at a compound annual growth rate (CAGR) of 5.44%.[9]

Conventional appliances currently dominate manufacturing with the largest share of the current market. These designs are dependent on centralized panels (one central control board or chip to govern the appliance) and analog systems that operate using continuous electrical signals or mechanical controls. Monolithic in design, all components in conventional appliances are tightly integrated into a single, cohesive unit. With functionality hardwired into the appliance, components are not designed to be independently replaced, upgraded, or networked.

Consumers can find conventional appliances across virtually all categories. This includes: washing machines with mechanical timer dials but no electrical sensors to determine water levels; top freezer/refrigerator models with humidity-controlled crispers and LED lighting, but only manual dial temperature controls; and dishwashers with mechanical or basic digital or turn knob controls offering normal, heavy, or light cycles but no cycle customization.

In essence, conventional appliances are serviceable but offer limited options beyond basic functions. Rather, they manage core tasks within the appliance itself and have no interaction with other devices, networks, or cloud services.

LOOKING AHEAD: EMERGING TRENDS IN SMART APPLIANCE DEVELOPMENT

Conversely, smart appliances are defined by their ability to connect with other products and platforms, as well as adapt to consumer needs and preferences based on sensor inputs. While currently a smaller share of the overall market, the global smart appliance market is poised for growth. According to Credence Research, the Smart Home Appliances Market reached USD 61.73 billion in 2024 and is expected to grow to USD 129.24 billion by 2032, at a CAGR of 9.01%[10]. – nearly double the overall global appliance projection. As mentioned earlier, this growth is attributed to rising consumer demand for connectivity, convenience, and energy-efficient living.

Manufacturers (OEMs) choosing to pursue this market opportunity must consider a series of emerging trends to design meaningful appliances that function beyond the limitations of their analog counterparts. The following overview outlines several key trends needed to ensure delivery of the advanced capabilities smart appliances proffer:

- **Modular and Scalable Architecture:** Foundational to their design, smart appliances are built using modular and scalable architecture in which each feature or function within the appliance is broken down into self-contained units or components, e.g., control boards, sensors, and communication modules. By developing, maintaining, and deploying these components independently, it makes it easier to manage complexity, allow for repairs, and conduct upgrades.

  Modularity also enables platform sharing, allowing for different appliances to use standardized, interchangeable components and software architectures. This creates multiple advantages for manufacturers, including reducing costs through economies of scale and streamlining production across product lines. It also allows new features (e.g., voice control, energy monitoring) to get rolled out across product lines more quickly and efficiently.

- **Compact, High-Density Design:** One of the challenges of smart appliances is their increased need for adequate physical space or "real estate" to accommodate a multitude of components. Manufacturers must carefully select the right-sized products and configure layouts. This means focusing on miniature space-efficient connectors and wiring for tight assemblies in compact, high-density designs, while considering key performance issues to ensure adequate operation.

- **Environmental and Mechanical Performance:** Thermal performance and vibration resistance are two such critical aspects. Appliances must manage, utilize, and regulate these issues to perform safely, efficiently, and consistently. Sensors and algorithms monitor and optimize heat and vibration in smart appliances, while design layouts are also critical to achieving maximum performance.

Managing Thermal Performance

All appliances must manage thermal performance one way or another. Ovens, dryers, and HVAC units must generate, distribute, and retain heat efficiently; conversely, refrigerators must remove heat effectively. Smart appliances present more complications as their use of microcontrollers, Wi-Fi modules, sensors, and displays not only generate additional heat but must be able to withstand the heat generated by the appliance itself. This requires designing these elements, along with connectors, to withstand ambient temperatures and limit the need for high-cost insulation practices.

While good thermal performance can improve overall energy efficiency and reduce waste heat, poor thermal management can cause malfunctions, affect connectivity, and ultimately reduce the appliance's lifespan – critical issues in smart appliances. Here's one example of a design solution: the control board in a smart oven is placed in a thermally isolated zone to prevent heat damage.

- **Ease of Use:** Accessibility is another consideration. Smart appliances must be designed to be smart for all users, including those with disabilities or sensory impairments. In the US, for example, this would include compliance with the Americans with Disabilities Act. While most features achieve compliance through access to user interface panels, additional features, such as voice control, remote access, and audible alerts, although not yet essential in meeting compliance standards, support greater accessibility and free up some mechanical constraints in compact designs.

  Tool-less serviceability is another design issue to include. The ability to open, replace, or service parts of an appliance without the need for specialized tools is another critical feature of smart appliances. To meet this goal, manufacturers should consider quick-access panels, modular parts that can be readily replaced, and self-diagnostics to expedite repairs. The added benefit of tool-less serviceability is that it reduces downtime, lowers maintenance costs (including do-it-yourself consumers), and improves the life of the product – an eco-friendly, sustainable result.

- **Smart and Connected Appliances (IoT Integration and Artificial Intelligence):** Integration with the Internet of Things (IoT) and advancements in Artificial Intelligence (AI) are fundamental to the connectivity that defines smart appliances. Together, these technological juggernauts are playing a pivotal role in shaping the future development of smart appliances through product innovations and seamless user experiences that address consumers' evolving preferences and expectations.

  Smart appliances must first rely on a microcontroller (MCU) or processor to run firmware and manage data on a single interface, and through a connectivity module that uses power signal connectors, establish access to the Internet. Addressing space limitations once again becomes a critical consideration. This requires the inclusion of miniaturized, high-speed connectors that secure communication among the various internal modules.

"AI is the game-changer. It has become a bigger and more important part of smart appliances, requiring the need to work with experts who understand how it overlays with components and system design."

-Ashish Ainapure

Manager, System Architecture, TE Connected Living Solutions

Smart appliances also require a combination of smart sensors and connectivity features that facilitate adaptation to user habits, optimize energy consumption, and ultimately extend the appliance's lifespan. They also play a critical role in supporting secure, reliable cloud-based features. This includes data storage and analyses that can adjust performance based on real-time feedback, voice assistant technologies to ensure authenticity, and the offer of appliance enhancements and recommended predictive maintenance.

- **Sensor-Driven Intelligence:** As a core function of smart technology, smart appliances collect real-time data from sensors to make automated, adaptive decisions for more intelligent, efficient, and responsive operation. Critical to this is sensor fusion, which combines data from multiple sensors to produce more accurate, reliable, and contextual information than any single sensor can provide.
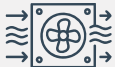
Coinciding with sensor fusion is edge computing – in effect, a form of localized AI. It allows for processing data directly from sensors where it's generated on the appliance and analyzing it in real-time. Only select, relevant data is sent to the cloud. Together, sensor fusion and edge computing play a critical role in adaptive performance and predictive maintenance.

Sensor-driven intelligence is also driving more innovations. By leveraging data from sensors, insights can be gathered from everyday life and activities to create automated, personalized experiences that fit consumer needs. This can include anything from adjusting the HVAC thermostat when falling asleep to turning on an oven to warm up food on select evenings. Ambient sensing is yet another step in the evolution of perfecting smart home environments.

Sensor Fusion Examples		
Smart Fridge	Temp + door sensor + camera	Detects a door left open and alerts users
Smart washer	Load weight + water turbidity + vibration	Optimizes wash time and spin speed for fabric care and water level efficiency to reduce waste
Edge-Computing Examples		
Smart Oven	Recognizes food via internal camera	Suggests cooking mode without internet
HVAC	Micro MATE-N-LOK Blind Mate Connector	Adjusts airflow for comfort when detecting changes in crowd/environmental density

- **Energy Efficiency and Sustainability**: As mentioned earlier, smart appliances are helping to answer consumer and regulatory calls for energy efficiency. A series of power management innovations is helping to drive that result.Smart appliances can now utilize advanced power electronics for more efficient motor control in washers, dryers, and HVAC units, and incorporate components such as high-efficiency inverters to improve conversion between AC/DC for electronics-heavy appliances. Connectors for power monitoring and adaptive control systems are used to scale the power required to lower energy usage based on workloads.

Energy Efficient Smart Appliances

- Inverter Motors use less electricity in washing machines, refrigerators, and air conditioners. These motors operate at variable speeds based on the load/conditions; the inverter also changes AC from wall outlets into optimal frequency and voltage for the motor. An energy-efficient inverter motor combines a smart controller and an optimized motor design to run only as hard as needed.
- Heat pump dryers are laundry dryers that use a heat pump system instead of electric heating elements or gas burners. By recycling hot air rather than constantly heating fresh air, they are energy efficient, using up to 50% less energy than vented or condenser dryers.

At the same time, sensor-driven efficiencies can be used to reduce energy draw. Incorporating bi-directional power flows, such as solar integration and battery backup, into smart appliance functions is another area where energy efficiencies are being explored. This allows an appliance to work with renewable energy sources and store energy for later use, not only proving to be more energy-efficient but also cost-effective and resilient during power outages.

Additionally, broader sustainability concerns are being addressed. Smart appliance manufacturers are using recyclable materials and developing repair-friendly designs to lower appliance downtime – an issue we will further address in the next section on safety.

- **Safety Considerations:** As every appliance OEM knows, safety design is paramount. It is the key to ensuring consumer confidence, avoiding harm or injury, and meeting standards to support environmental goals. And in a world moving towards a more connected future, engineers face the challenge of designing for durability and compliance with global safety standards.

In smart appliances, which are designed to be more energy-efficient and environmentally responsive, the use of eco-friendly materials has become a must. This is largely a direct response to concerns over electronic waste resulting from appliance production. During the use, collection, treatment, and disposal of appliances, harmful (hazardous) substances such as lead, mercury, and cadmium may be released, which can cause significant environmental and health concerns. Eco-friendly material usage helps alleviate this problem, particularly in the face of compliance standards.

In the EU, for example, several strict regulations are in effect. The Restriction of Hazardous Substances (RoHS) is legislation that currently restricts the use of 10 hazardous substances (including lead, mercury, and cadmium) in all products with an electrical component. The corresponding Waste from Electrical and Electronic Equipment (WEE) directive promotes the collection and recycling of appliance equipment, including how to recover it. These directives coexist with another EU regulation, REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals), which controls chemical exposure and usage.[11]

As previously mentioned, regulations in the US typically reflect state-enacted policies. For example, California's Proposition 65 requires a warning about significant exposures to chemicals that cause cancer, birth defects, or other reproductive harm. If an appliance contains any evidence of chemicals from a prescribed list, it will be slapped with a Prop 65 label.[12] As a result, this regulation encourages manufacturers to reduce or disclose harmful chemicals, which results in the production of safer, eco-friendly designs – the very essence of smart appliances.

Taking these regulations into account, manufacturers must design safe appliances that present low risks of harmful emissions. This is particularly the case in the highly regulated EU – a market poised for significant growth in smart appliances. As a result, smart appliance makers choose to emphasize RoHS/REACH compliance and Prop 65 safety as key selling points, aligning with eco-friendly concerns and consumer trust as a competitive edge.

LET'S BUILD SMARTER, TOGETHER

Manufacturers (OEMs) looking to develop smart appliances have a myriad of issues to consider. In terms of marketplace demands and opportunities, smart appliance design must focus on meeting consumer lifestyle preferences and be able to integrate into smart homes and offices.

From an engineering standpoint, however, manufacturers must develop appliances that build on emerging regulatory and technical trends. The goal is to deliver safe, superior products with long lifecycles and low failure rates among interconnected modules and components.

This requires effective design elements across the spectrum. Components must be:

1. Miniature to accommodate limited physical space
2. Capable of conducting high power at significant voltage levels
3. Able to easily integrate into various modules and systems
4. Provide a protective seal from water and other corrosive elements
5. Offer an ease of assembly and repair

| Miniaturization | High power | Integration | Seal | Easy of assembly |

MANUFACTURERS LEVERAGE TE'S SYSTEM ARCHITECTURE EXPERTISE

By **holistically understanding** smart appliance design, TE's knowledge extends beyond our expertise in electrical connectors and industry-leading miniaturized components. Rather, we understand how all these pieces must fit together within complex smart appliance designs.

Our purview includes knowledge of control systems, power delivery, signal interfaces, and end-user or operator/ repair interactions, allowing us to recommend or design connector solutions optimized for overall performance standards and costs at the system level. This also enables the simplification of wiring harnesses, reduces SKUs, and ensures that interconnects match additional modular, smart-enabled appliance architectures. In essence, we can help OEMs design for today to develop new solutions for tomorrow.

Core Systems:	Interconnectivity Needs:
• Power supply and distribution	• Internal wiring harnesses
• Motor drives (BLDC, inverter tech)	• External power/data connectors
• Control units (MCUs, PCBs, IoT modules)	• EMI shielding, sealing, durability
• Sensors (temp, humidity, weight, vibration)	

Our knowledge of **modular architecture** is also critical. Designing modular connector systems that can be reused across multiple appliance models or platforms supports faster product development and more efficient manufacturing. TE can assist OEMs in building multiple appliance variants using common interconnect modules, reducing tooling and validation efforts.

Creating **standardized connector interfaces** that align with industry protocols is essential in smart appliances and is one of our core capabilities. This supports OEMs by simplifying integration and facilitating upgrades with interfaces such as smart sensors and UI panels.

And as previously implied, helping OEMs plan for tomorrow is a clear goal. This requires **scalability and extensibility**, designing connectors and systems with foresight into emerging trends and future-proofing both low-cost and high-end models. We do this while recognizing the emerging trends and consumer issues that are shaping the smart appliance marketplace.

"Both the engineering and supply chain support TE provides has given us a competitive edge in today's market. Their deep understanding of appliance architecture, combined with consistent engagement on market trends, has enabled us to align our designs within tight timelines to meet our evolving consumer expectations."

-TE Client

TOMORROW'S BREAKTHROUGHS START WITH TODAY'S PARTNERSHIPS

Through relationships with major manufacturers, TE helps create smart appliances that respond to human touch, sense vibration, adjust to loads, and operate more efficiently.

Our global network of engineers offers custom solutions to meet customers' design requirements. This is based on our industry-specific expertise, reflecting deep knowledge of the appliance industry to develop tailored solutions that meet a manufacturer's needs. It also works in parallel with our customer-centric approach that emphasizes close collaboration.

OUR KNOWLEDGE EQUATES TO OEM OPPORTUNITIES

While TE is regarded for leadership in electrical connectors, our knowledge and expertise in smart appliance system architecture are powerful assets to leverage beyond our product portfolio. This is the formula for long-term partnerships.

Building on our capabilities as component suppliers, our TE Connected Living Solutions team can partner with OEMs, and, by joining forces, **become innovators of system solutions**. We stand ready to work with OEMs to address opportunities, evaluate challenges, and co-develop solutions that meet future needs. Together, we can be smart in defining the next generation of connected living solutions.

"Customer partnerships are in the DNA of our approach and increasingly critical to successful new innovations. In our connected living world, forging connections with our customers is a primary ingredient in smart system design."

-John Marsh

Engineering Fellow, Core Technology, TE Connected Living Solutions

TE CONNECTIVITY: STRATEGIC INNOVATION PARTNER

Component Leadership	System Solution Innovation
Quality and Reliability: Our high-quality products are known to meet stringent industry standards. Components are designed to withstand harsh environments, temperature fluctuations, and frequent use, which is crucial for appliance longevity and customer satisfaction.	Innovation and Technology: TE invests heavily in research and development, continually introducing innovative solutions that help appliance OEMs stay ahead of market trends. This includes advancements in areas such as miniaturization, energy efficiency, and smart appliance technologies and systems integration.
Compliance and Safety Standards: Our component products comply with various international safety and quality standards, which is crucial for appliance manufacturers operating in multiple markets. This compliance helps OEMs streamline the certification processes.	Environmental Considerations: TE is committed to sustainability, offering eco-friendly solutions and working towards reducing the environmental impact of our customers' products. This directly aligns with the growing demand for smart, sustainable appliances and how best to design them.
Product Range and Customization: We provide a wide range of electrical and electronic components specifically designed for appliance applications. This includes connectors, sensors, relays, and wire and cable solutions.	Technical Support and Expertise: We combine deep engineering expertise across the gamut of smart appliance design – focusing on electrical architecture to deliver the right components, design the right system, and develop the connected living solutions demanded in today's increasingly smart world.
Supply Chain Reliability and Global Presence: With a strong global footprint, TE can provide localized support and ensure a stable supply chain for OEMs operating in different regions. Our global presence helps to reduce lead times and manage supply chain risks.	Long-term Partnership Potential: Our relationship and client-centric approach serveas a foundation for developing strong partnerships. Perhaps more importantly, we can leverage our leadership position in components and combine it with greater systems expertise to design even smarter, smart solutions.

"Teardowns provided critical systems-level support that demonstrated TE's value as a strategic partner, while both in-house and customer teardown analyses yielded invaluable design considerations. This collaborative approach enabled us to proactively address future needs and develop forward-thinking design solutions."
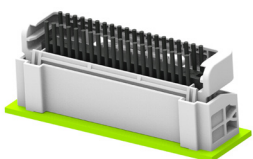
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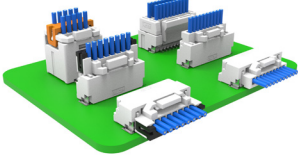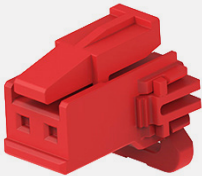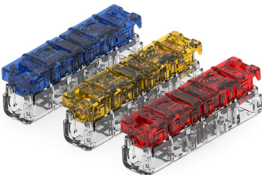
DESIGNING A SMART APPLIANCE REQUIRES THE FOLLOWING:

• Motors and Compressors: High-voltage, vibration-resistant connectors

• Heating Elements: High-temp, corrosion-resistant terminals

• Control Boards: Low-voltage signal connectors, board-to-board solutions

• Sensors and IoT Modules: Miniaturized, shielded data connectors

• User Interfaces (HMI): Durable, low-profile connectors for displays, touchpads

FEATURED BELOW ARE SELECT TE COMPONENTS THAT FIT THESE NEEDS:

"Switching to Flip-N-Lok spread like wildfire. Our platforms have reduced assembly time by over 40%, saved critical board real estate, and eliminated troublesome non-seated connectors. I flippin love this connector."

-TE Client

Product	Description and Benefit	Features
FLIP-N-LOK Wire-to-Board Signal Connector Applications: Refrigeration; HVAC 	FLIP-N-LOK High-density wire-to-board solution is designed to free up printed circuit board (PCB) space, and enhance overall assembly efficiency and ergonomics. By replacing multiple signal headers, connector enables a cleaner layout and reduces assembly takt times.	• Modular high-density connector • Lever locking mechanism helps improve ergonomics • Polarization feature on housing • Terminal keying to minimize errors in assembly • Mates to standard 1.57mm thick PCB • Suitable for wave-soldering process: peak temp range of 255°C to 270°C; duration: 2-5 Sec
GRACE INERTIA (GI) Multi-Load Connector Applications: Refrigeration, Dishwashers; HVAC 	GI Multi-Load Connectors offers design flexibility to PCB manufacturers requiring integrated, multi-functionality in wire-to-board solutions. The header can accept multiple plugs to simplify sourcing and assembly, and allows the PCB to fit into space-limited designs.	• 14.1mm low mating height, • Pre-mounted terminal position assurance (TPA) device and color/keying options to improve assembly • Operating temp (°C): -40 to +105 • IEC 60335-1 Glow-Wire Available • UL94 Rating - V-0
POWER KEY 5.0 Surface Mount Technology Connector Applications: Washing Machines; HVAC 	Power Key 5.0 Surface Mount Technology (SMT) Connectors offer an efficient solution for manufacturers using automated assembly to build compact printed circuit board (PCB) systems. All power key 5.0 SMT headers accommodate potted PCB designs, including water-exposed applications.	• 21mm low mating height and recessed SMT pin design allow design flexibility • Color and keying options help identify different configurations and prevent mis-mating • Gap in housing allows easy inspection of pin soldering • Optional terminal position assurance (TPA) device for 4 & 6 position versions, provides greater contact reliability

Product	Description and Benefit	Features
Micro MATE-N-LOK Blind Mate Connector Applications: Ovens; HVAC	Micro MATE-N-LOK Blind Mate Connector helps improve the efficiency of wire harness assembly by reducing the need for visual checks and simplifying connector alignment. Operators, installers, and end-users can readily seat terminals in the correct position for reliable connections, and can complete connections from difficult angles with effortless operation.	• Lead-in funnel structure provides a large surface area for connector alignment • Side integrated terminal position assurance (TPA) is easily applied and released in confined spaces • Housing with error-resistance helps to secure correct insertion of the terminal
SIGNAL GRACE INERTIA (SGI) 1.25mm and 1.50mm Connectors Applications: HVAC	SGI connectors are designed to optimize miniaturized PCB designs, utilizing a small footprint while maintaining reliability to deliver robust performance. Surface Mount Technology (SMT) connectors with wire-to-board configurations also streamline automated assembly with pick-and-place compatibility.	• 1.25mm or 1.50mm pitch and a low-profile 5mm right-angle header • Standard inertia locking mechanism and a solder peg for enhanced retention • SGI 1.25mm connector system is very compact (small footprint); its single row version is Glow Wire Tested • Error-resistant "poka-yoke" design, including keying and color coding to reduce errors • Vertical and right-angle headers, single and dual-row configurations, and optional terminal position, afford flexibility • Operating temp (°C): -40 to +105 • Wire Sizes: 24 - 28 AWG
EEPROM Embedded Smart Connector Applications: Refrigeration	The EEPROM Smart Connector simplifies production by using a single control board across product families. Compact design reduces costs, streamlines inventory, and speeds up field service to tackle customer problems with a low-cost, robust solution. Winner: Design World 2024 LEAP Award	• Reliable product authentication, PCB personality assignments, and data logging access to service data • Simple assembly process • Input voltage: 3V-4.5V • Header plug: EP 2.5 • EEPROM: 2-wire interface • Comm protocol: Single wire interface IIC • Operating temp (°C): -40 to -85
COMPACT SEAL SPLICE Applications: Washers; Dishwashers	Compact Seal Splice creates a robust wire-to-wire connection and protects connections against harsh environments, including water and UV exposure. Ergonomic design with an insulation displacement contact (IDC) to provide easy installation.	• Color-coding helps reduce the risk of mis-mating • Flexibility and safety, with a small size for installation in confined spaces • Flame-resistant materials meet UL 94 V-0 and glow wire test (GWT) standards • Operating temp (°C): -40 to +105 • Wire size (AWG): 18-12 • Sealed version available • Wire-to-wire available configurations

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About TE Connectivity

TE Connectivity plc (NYSE: TEL) is a global industrial technology leader creating a safer, sustainable, productive, and connected future. Our broad range of connectivity and sensor solutions enable the distribution of power, signal and data to advance next-generation transportation, energy networks, automated factories, data centers, medical technology and more. With more than 85,000 employees, including 9,000 engineers, working alongside customers in approximately 130 countries, TE ensures that EVERY CONNECTION COUNTS. Learn more at www.te.com and on LinkedIn, Facebook, WeChat and Instagram.

Connect With Us

We make it easy to connect with our experts and are ready to provide all the support you need.
Visit **te.com/support** to chat with a Product Information Specialist.

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TE Connectivity
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