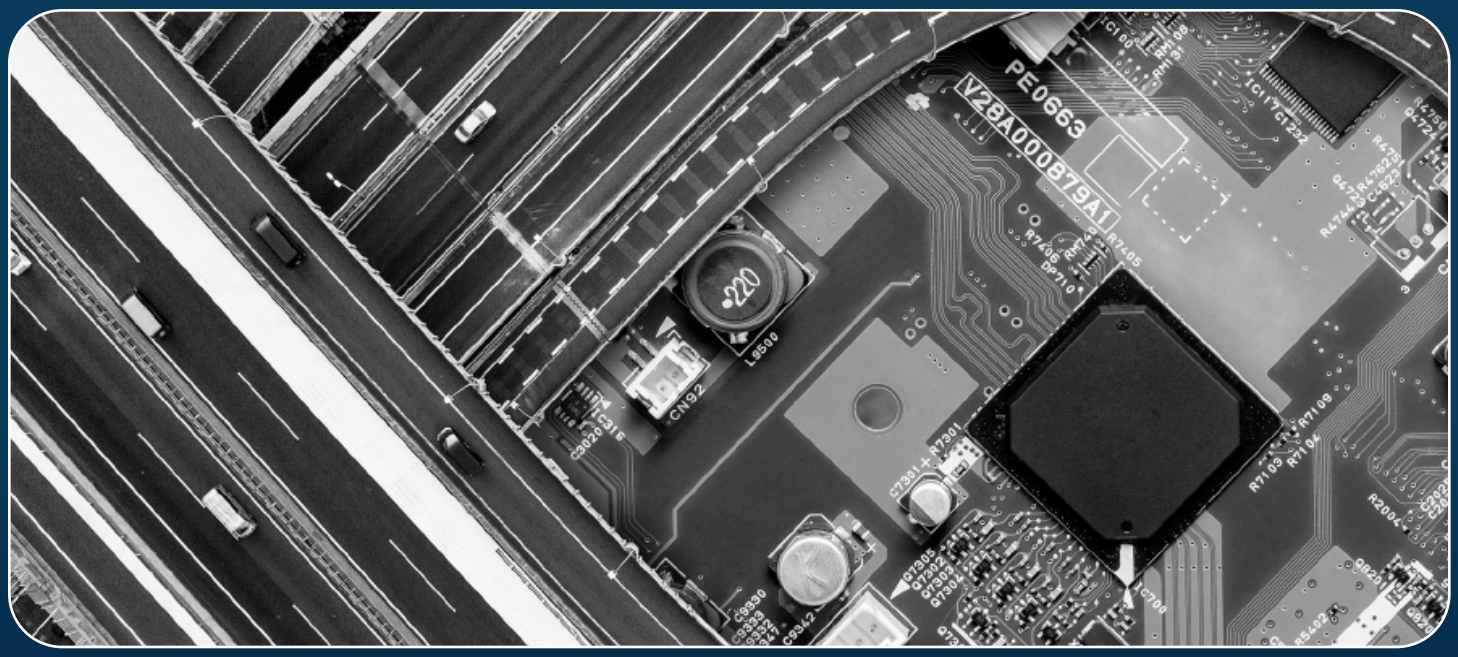
EXECUTIVE SUMMARY

ElectronicDesign

Designing for the Future: 3M Interconnect & Electronics Solutions for Next-Generation Applications



Presenters:
Gregg Couture, Interconnect Sales and Channel Leader, 3M
Joe Petri, Sales Manager for Display and Electronics Product Platforms - US & Canada, 3M

OCTOBER 28, 2026

in partnership with

The IP&E Specialist

3M

OVERVIEW

As electronics continue to evolve toward greater miniaturization, higher performance, and increased reliability demands, engineers and procurement professionals face mounting pressure to source solutions that address multiple design challenges simultaneously.

3M's portfolio of interconnect solutions and complementary products, such as absorbers, cushioning materials, and polyimide tapes, address common pain points such as signal integrity degradation, electromagnetic interference, mechanical instability, and component protection in demanding environments. 3M is a multidisciplinary materials science and manufacturing company that brings together diverse technology platforms, differentiated capabilities, a global footprint, and operational excellence to deliver innovative, customer-focused solutions. 3M leverages its technical expertise to provide "bench-to-bench" collaboration with engineers across the entire design and assembly cycle.

TTI is an official authorized distributor of 3M, giving customers access to 3M's extensive electronic component inventory, helping OEMs reduce supply complexity.

CONTEXT

The presenters discussed the complex requirements of modern industrial printed circuit board (PCB) design and highlighted 3M solutions that help overcome critical design challenges to achieve optimal performance, reliability, and durability.

KEY TAKEAWAYS

3M solutions help maintain performance, reduce design risk, and enable next-generation electronic systems.

Customers from all segments of industrial electronics are consistently prioritizing three main outcomes: performance and reliability, design and integration flexibility, and manufacturability with high throughput.

In industrial PCB design, reaching these outcomes requires balancing several interconnected factors, including signal integrity, miniaturization, mechanical stability, thermal management, EMC/EMI compliance, and assembly efficiency. All these areas play a critical role in long-term system reliability and production yields; therefore, utilizing a well-matched material solution for each will maximize performance, manufacturability, and reliability.

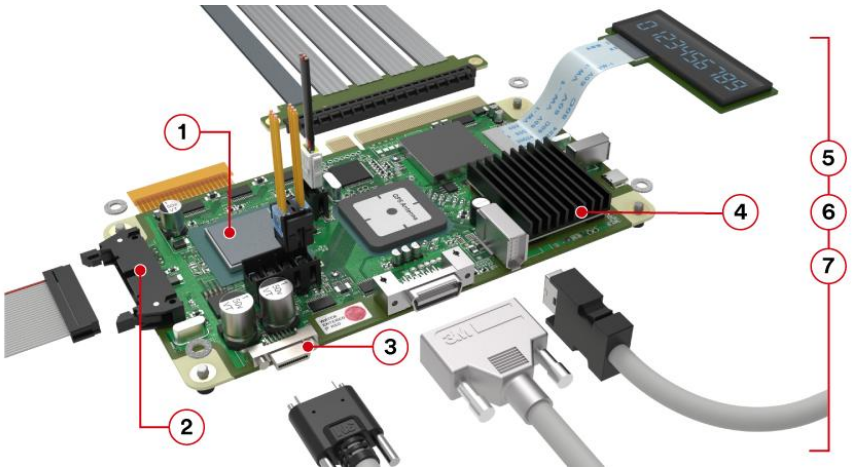
3M materials and interconnect solutions are designed to help engineers achieve the optimal balance without compromising cost, timelines, or regulatory requirements. 3M's broad portfolio of materials and interconnect technologies enables manufacturers to address issues throughout the industrial PCB product lifecycle, from initial design through assembly and field maintenance.

Figure 1: 3M design and assembly solutions for industrial PCBs

1. Signal Integrity
2. Mechanical Stability
3. Miniaturization
4. Thermal Management

Across the board:

5. EMC Compliance
6. Assembly
7. Bonding



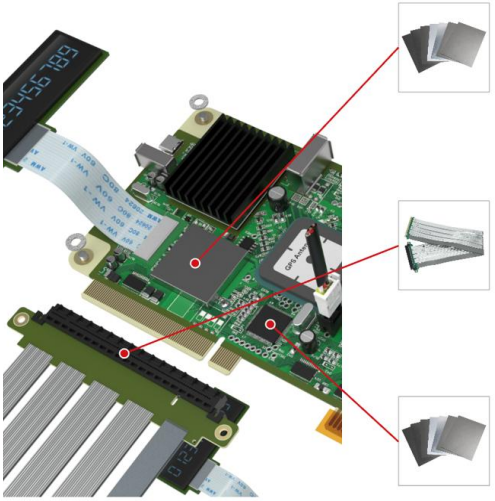
Signal Integrity

Poor signal integrity can result in intermittent failures, incorrect data, system resets, or even complete equipment failure. At the same time, industrial systems often contain high-speed data, long cable runs, and electrically noise environments, making signal integrity an especially challenging problem to solve.

3M offers several solutions for industrial PCBs to ensure clean, consistent signal transmission. EMI absorption and magnetic shielding materials, along with high-frequency signal integrity management capabilities, contain unwanted noise even at high data rates, preventing signal degradation. 3M's localized noise mitigation offerings, such as the AB3000 absorber and shielding material series and the AB600S5HF shielding absorber, tackle EMI directly at its source—an especially important capability in dense, space-constrained modern electronics designs.

In addition, 3M's high-speed flexible cables allow designers to route and position components without compromising performance. The Twin Axial uses continuous longitudinal shielded construction to provide high-bandwidth, low-loss, and resonance-free signal transmission while remaining highly flexible. The cable can be bent, folded, or routed with minimal performance impact.

Figure 2: Various 3M solutions help ensure signal integrity



3M™ EMI Absorber & Magnetic Shielding Material AB3000 Series
Value: Absorb unwanted frequencies to limit escape from shield can

3M™ Twin Axial PCI Express Extender Assemblies Gen 5.0
Value: Bend and fold 3M TwinAx high-speed cable with minimal impact on signal integrity

3M™ EMI Shielding Absorber AB6005SHF
Value: Combination absorber and shielding tape that is highly effective in confined spaces

Miniaturization

As PCB designs become smaller, designers must fit more functionality into less physical space while preserving higher reliability, yet higher trace density and more powerful components can introduce more heat, EMI, and mechanical stress, especially in harsh industrial environments.

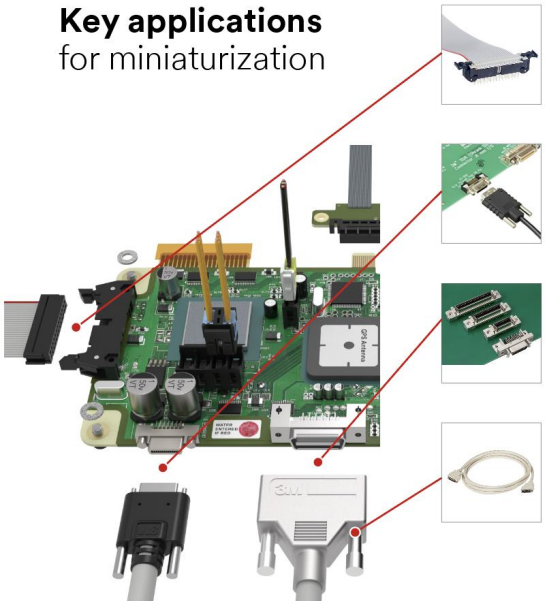
3M's compact connectivity solutions overcome these challenges, allowing designers to maximize board space and simplify layouts while ensuring strong signal integrity. High-density connectors, fine-pitched connectivity, cable-to-board miniaturization, and ruggedized offerings help make electronic systems smaller, lighter, and more powerful without compromising reliability or performance.

The Socket 451 and Header 452 series use only 0.050-inch pitch—half the conventional 0.100-inch pitch—and support configurations of up to 50 signals. The MDR and SDR connector systems similarly use a 0.050-inch ribbon-style contact, allowing more connections within a smaller footprint while maintaining stable electrical performance and consistent mechanical retention.

> "Our Mini Delta Ribbon and smaller Shrunk Delta Ribbon connector systems have been delivering reliable, high-density performance for applications ranging from industrial equipment and motion control systems to machine vision and general high-speed I/O, for decades."
>
> – *Gregg Couture, 3M*

3M's clamp series portfolio (i.e. Mini Clamp, Power Clamp, and Link Connector systems) are an ideal choice for field maintenance, enabling quick and reliable termination of multiple wires with no wire stripping required, which saves time, reduces risk of conductor damage, and minimizes waste.

Figure 3: 3M solutions are designed for optimal performance in compact component-dense spaces



3M™ Socket 451 and 3M Header 452 Series
Value: Compact, space-saving connector system

3M™ Shrunk Delta Ribbon (SDR) System
Value: Space-saving board and wiremount connector with reliable PCB retention

3M™ Mini Delta Ribbon (MDR) System
Value: Space-saving board and wiremount connectors with reliable PCB retention for rugged environments

3M™ Mini Delta Ribbon (MDR) Cable Assemblies
Value: Completed cable assembly

3M™ Mini Clamp, Power Clamp & Link Connector Systems
Value: Miniature IDC connectors for sensors and other signal devices.

Mechanical Stability

Industrial PCBs often experience vibration, shock, and mechanical stress that can crack solder joints, loosen connectors, or damage components over time. Although these forces may not cause immediate problems, they can often lead to failures—and expensive downtime—after extended operation time. To ensure long-term reliability, designing for mechanical stability is crucial.

3M offers a range of solutions with key capabilities that provide mechanical durability, reliability, and long-term performance in demanding applications. Vibration damping, shock protection, and structural reinforcement protect components and prevent board flexing. Secure connector retention and cable strain relief reduce the risk of failures in high-motion environments. Custom-fit mechanical integration helps optimize performance in tight or complex designs.

3M's molded-on cable assemblies are especially rugged for operation in demanding space-constrained environments. The socket is thermally fused to the cable, creating an integrated, low-profile strain relief and encapsulating exposed conductors. Another solution, 3M's peel-and-stick Bumpon protective bumpers, are available in hundreds of shapes and sizes for spacing and vibration damping.

Figure 4: 3M solutions support robust electromechanical integration



CONFOR™ SC Foam or ISOLOSS™ Elastomer Isolators (Aearo Technologies LLC, a 3M company)
- Value: Helps prevent PCB flexing and detachment during impact and drop shock

3M™ Molded Assemblies
Value: Shield against elements, including high vibration to remove risk of accidental disconnection

3M™ Bumpon™ Protective Bumpers
Value: Absorb vibrations and noise, allow for good air circulation and help prevent board flexing

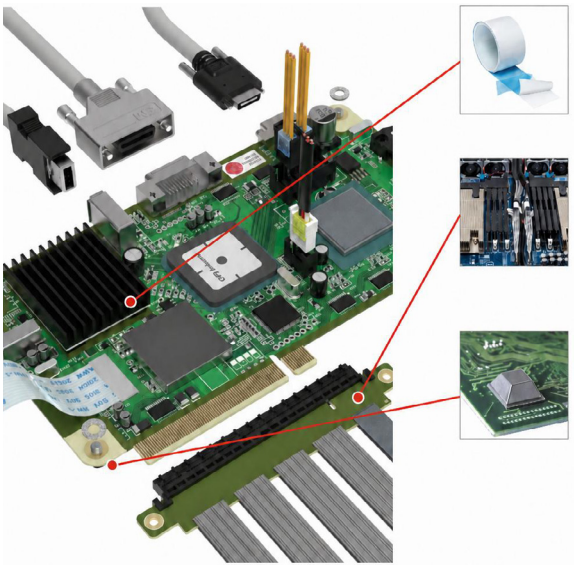
Thermal Management

Increasing power density makes thermal management critical, as excessive temperatures can alter electrical characteristics, reduce performance, shorten product life, and eventually cause complete failure. System-level thermal efficiency ensures each element works in concert to maintain safe operating temperatures and long-term reliability.

3M's core capabilities in thermal management for industrial PCBs include thermal interface materials, heat transfer and conduction optimization, airflow management, thermal gap filling, and component spacing for passive cooling. These capabilities help optimize performance, extend component life, and support increasingly power-dense electronic systems.

Thermal management aims to transfer heat efficiently from high-power components into heat sinks or other cooling structures while maintaining consistent thermal contact. 3M's 8810 Thermally Conductive Adhesive Transfer Tape is designed for high adhesion and provides a degree of elongation to accommodate thermal expansion and contraction.

Figure 5: 3M offers solutions for effective thermal management across diverse environments



3M™ Thermally Conductive Adhesive Transfer Tape, 8810
Value: Good thermal conductivity and good electrical insulation

3M™ Twin Axial Extender Assemblies for PCI Express Gen 5.0
Value: Bend and fold 3M TwinAx high-speed cable to avoid obstructing cooling airflow, redirect airflow, and help improve thermal management

3M™ Bumpon™ Protective Bumpers
Value: Improve spacing to allow for good air circulation

EMC/EMI Compliance

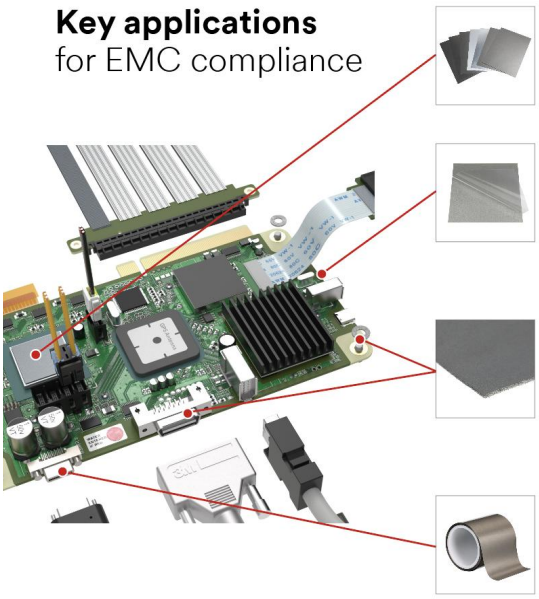
Uncontrolled emissions can disrupt nearby equipment, while systems with inadequate immunity are more vulnerable to external electrical disturbances. Strong EMC performance ensures reliable operation alongside other machinery while meeting regulatory requirements

Achieving EMC compliance is a system-level challenge requiring several key capabilities, including electromagnetic emission suppression, electrical grounding and continuity, conductive bonding between PCBs and enclosures, gap-filling and conductive gasketing, cable and connector grounding optimization, and broadband EMI mitigation across frequencies.

> "Together, these capabilities help you reduce risk, streamline your certification, and help you ensure reliable systems in regulated environments."
>
> – *Joe Petri, 3M*

3M offers a range of EMC solutions, including targeted EMI absorbers, conductive double-sided tape, conductive gasket materials, and conductive fabric tape. These materials used in different combinations can help designers meet an extensive range of electrical conductivity, grounding, shielding, adhesion, compression, and conformability requirements.

Figure 6: 3M solutions for EMC/EMI management



3M™ EMI Absorber & Magnetic Shielding Material AB3000 Series
Value: Help eliminate radiated and conducted emissions

3M™ Electrically Conductive Double-Sided Tape 9793KW Series
Value: XYZ electrically conductive pressure-sensitive adhesive (CPSA) offering adhesion and grounding performance to many surface types

3M™ Electrically Conductive Gasket Tape MSG7000SDX Series
Value: Highly compressible foam construction for wide range of gap filling and grounding

3M™ Electrically Conductive Single-Sided Tape 5113SFT
Value: Excellent grounding for cables with small contact areas for microelectronics

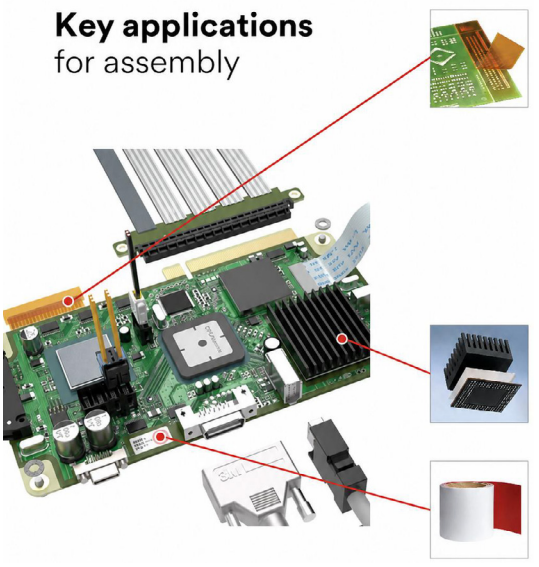
Assembly Complexity

Production teams must maintain high yields, fast throughput, and consistent quality even as designs become increasingly compact, thermal constraints intensify, and manufacturers face disruptive component shortages. As a result, simplifying assembly processes has become a top priority across the industry.

3M offers high-temperature masking tapes, bonding materials, selective electrical conduction solutions, and process protection and defect detection products to help streamline production, improve quality, and support advanced electronic designs.

3M Polyimide Film Tape protects sensitive components during assembly operations, with clean removability to reduce cycle time and improve reliability. 3M also offers Water Contact Indicator Tape, which changes color when exposed to water, providing a simple visual method for detecting water ingress during manufacturing or later troubleshooting.

Figure 7: 3M's assembly simplification and protection solutions reduce rework



3M™ Polyimide Film Tape 5413 / 5419 Series
Value: Helps protect sensitive components during soldering process

Finished Assembly Solutions
- 3M™ USB3 Vision Cable Assemblies (1U30G Series)
- 3M™ CoaXPress Cable Assembly 1CXx-xx-0G Series
- 3319 High Flex Ribbon Cable
- 3322 High Flex Ribbon Cable (0.025" pitch)

3M™ Thermally Conductive Adhesive Transfer Tape 8810
Value: Good thermal conductivity and good electrical insulation

3M™ Water Contact Indicator Tape 5557
Value: Shows water intrusion on PCB

Beyond individual materials and components, 3M supplies finished cable assemblies, including products for industrial machine vision, USB 3 Vision, CoaXPress, and high-flex applications.

ADDITIONAL INFORMATION

To learn more, visit 3M and TTI

BIOGRAPHIES



Greg Couture
Interconnect Sales and Channel Leader
3M

Gregg Couture is the Interconnect Sales and Channel Leader at 3M, where he is passionate about influencing OEM design specifications with his technical sales team, and driving the channel strategy for 3M's Interconnect portfolio. With more than 24 years of experience in the electronics industry, Gregg has been selling 3M Interconnect solutions for the last 18 years addressing key design challenges such as signal integrity, miniaturization, and mechanical stability across countless customer applications.



Joe Petri
Sales Manager for Display and Electronics Product Platforms - US & Canada
3M

Joe Petri is the Sales Manager for Display and Electronics Product Platforms for the United States and Canada at 3M, where he drives technical specifications and customer engagement for a portfolio that includes EMI/RFI management solutions, electronic assembly materials, and eAbrasives. In this role, he works closely with OEMs and engineers to help design and enable next-generation electronic solutions, addressing challenges related to miniaturization, performance, and reliability. Joe has been with 3M for 18 years and has spent the past 8 years within the Display and Electronics Product Platform, building deep expertise in its technologies and customer applications. He previously served as a portfolio manager within 3M's industrial division, where he developed a strong foundation in product strategy and market-driven innovation.

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