No time for downtime.
Less Down Time. More up-tempo.

- Immersion Cooling
- Moisture & Corrosion Protection
- Electronics Cleaning
- Vibration and Acoustic Control
- EMI/EMC Management
- Cable Assemblies
- Bonding Solutions
- Thermal Management Materials
- Labeling Materials
The pace of server innovation is extraordinary. There is a constant demand for improved performance and reliability. Designers are ever challenged to push these performance limits while managing space, thermal, vibration, and EMI/EMI concerns. With products that help address these limitations without sacrificing performance, 3M can help minimize design constraints.

Along with from heat, vibration, noise issues, EMI and EMC, servers are also being placed into even more demanding environments that include moisture and environmental pollutants. 3M can help manage these design concerns and provide improved protection and cleaning.

Thanks to our innovative solutions, taking your data center servers to a better place is no longer tomorrow’s dream. It’s happening right now.
Minimizing design constraints

Data center servers are continually pushing the limits – how much computing can be packed into a server. This makes design constraints, such as space and thermal concerns, limiting factors in the design. With products that address these limitations without sacrificing performance, 3M can help minimize these design constraints.

Cable Assemblies & Interconnects

The low-profile capabilities of 3M™ Twin Axial Cable Assemblies save a substantial amount of internal space and help alleviate congestion inside dense server systems – giving design engineers considerably more room for server architecture options.

**Configurations**
- PCI Express, HD miniSAS, SATA, SAS

**Twin Axial Cable Assemblies**
- 1 mm Bend Radius
- Lower Power
- Lower Cost
- Less Latency
- Improved Routing

**Beyond Twin Axial Cables**
- Connectors – e.g. miniSAS, SATA, SFP+, HDSAS+
- Wiremount cable assemblies, headers, and sockets
- Boardmount connectors
- Flat ribbon cable

Bonding Solutions

3M offers a broad range of bonding solutions with a variety of tapes, adhesives, and fasteners to help make bonding reliable and simpler.

**3M™ Bonding Products**
- Adhesive transfer tape
- Temporary surface protection tapes
- Slick surfaces tape
- Structural adhesives
- VHB™ tapes
- Reclosable fasteners
- Double coated tape
- Foam tape
- Packaging tape
- Electrical insulating tape

Thermal Management Materials

**3M™ Thermally Conductive Greases**
High performance thermal interface materials for transferring thermal energy from a heat source to a heat sink.

**3M™ Thermally Conductive Epoxy Adhesives**
Thermally conductive epoxies with minimal odor and superior structural strength. Ultra-thin bond lines help achieve low thermal impedance.

**3M™ Thermally Conductive Interface Tapes**
Range of high adhesion thin tapes offering efficient thermal transfer for applications requiring a thermal management solution.

**3M™ Thermally Conductive Interface Pads**
Soft, conformable pads provide high levels of conductivity for the more demanding applications in the electronics industry.
Heat Transfer Fluids

For server manufacturers looking for more efficient ways of cooling, 3M’s dielectric fluorochemical heat transfer fluids can help provide the solution. 3M™ Fluorinert Electronic Liquids have been used for electronics cooling beginning in the 1950s for demanding heat transfer applications, including military avionics, supercomputers, and power controllers. Also, 3M™ Novec™ Engineered Fluids, introduced as replacements for ozone-depleting substances such as CFCs, are dielectric heat transfer fluids that are helping to revolutionize server cooling.

With our 50 year history of heat-transfer applications in forward technologies, the future for server thermal management continues to burn a little cooler.

Immersion Cooling

3M™ Novec™ Engineered Fluids

- Are dielectric fluids which allow them to safely come in direct contact with electronics
- Have outstanding environmental profiles (non-ozone depleting, low GWP)

3M Two-Phase Immersion Cooling

Two-phase immersion cooling (2PIC) using 3M™ Novec™ Engineered Fluid is proving to significantly increase power density, reduce energy consumption and deployment time and deliver environmental sustainability. By taking advantage of Novec fluid’s relatively low boiling point and resulting phase change, this technology can achieve extreme energy efficiency.

Advantages over conventional air cooling

<table>
<thead>
<tr>
<th></th>
<th>Increased power density per rack</th>
<th>More computing power in less space</th>
<th>Dramatically less energy used for cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>4 - 40 kW</td>
<td>Up to 10 kW per m²</td>
<td>1.1 - 2.0 pPUE</td>
</tr>
<tr>
<td>3M™ Novec Engineered Fluid</td>
<td>Up to 250 kW</td>
<td>Up to 100 kW per m²</td>
<td>&lt;1.02 pPUE</td>
</tr>
</tbody>
</table>

Other Cooling Technologies:

In addition to two-phase immersion cooling using Novec fluids, 3M’s fluorochemical fluids can be very effective, offering benefits such as improved heat transfer over traditional systems, safe for use with electronics, and offering easier cleaning/maintenance.

- Single-Phase Immersion Cooling
- Direct-to-Chip Cooling
- Rear Door Heat Exchanger Cooling
Providing device protection

Data center servers have unique challenges. Vibration, noise, EMI and EMC, and excessive heat can impact performance, overall life, and the integrity of compliance labeling. 3M can help manage these design concerns and provide improved device protection.

Vibration and Acoustic Control

- Design & Modeling
- Acoustic Testing
- Application Engineering

**ISODAMP® C-8000 Series**
Thermoplastic elastomer molding material that combines excellent damping performance with mechanical strength

**ISOLOSS® SL Thermoset Polymer**
Highly damped, low modulus, thermoset compounds with exceptional molding stability

**CONFOR® Foams Electronics Formulations**
Medium density, open-celled polyurethane foams suitable for shock isolation in electronics equipment

EMI/EMC Management

3M™ EMI Absorbers and 3M™ Flux Field Directional Materials (FFDM) are designed for protecting EMI noises and improving data flex performance, high speed communication and increase signal integrity (s/n ratio).

Other EMI/EMC Management

- 3M™ EMI Shielding Foil and Fabric Tapes offer reliable grounding, EMI shielding, ESD protection and static charge draining
- 3M™ Electrical Conductive Gaskets offer outstanding gap-filling set while maintaining good electrical grounding

**Attenuation (S11 Reflection Loss) and Power Loss**

*Attenuation measure by 7mm coaxial verification kit under short fixed condition

Labeling Materials

When labeling is critical to operation and safety... 3M™ Thermal Transfer Durable Polyester Label Materials are designed to provide long-lasting performance under harsh conditions – intense heat, abrasion, exposure to harsh chemicals.

- Topcoat provides image protection for most applications without a protective overlaminate
- High abrasion resistance combined with excellent chemical resistance
- High performance 3M adhesives
Helping to ensure quality

The demands placed on data center servers is extraordinary and they have been designed to meet these ever-growing needs. Contamination during the manufacturing process or from environmental factors once operational can result in reduced performance and potentially premature field failures. 3M products can help clean and protect these servers to help ensure quality.

Electronics Cleaning

Precision cleaning solutions with 3M™ Novec™ Engineered Fluids help to improve productivity and reliability

- Effective on wide range of contaminants
- Not electrically conductive
- Outstanding penetration of tight clearances in complex parts
- Non ozone-depleting, low global warming potential, low in toxicity

Cost-effective alternative to aqueous cleaning systems

<table>
<thead>
<tr>
<th>Process</th>
<th>Aqueous System</th>
<th>3M™ Solvent System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Startup Costs</td>
<td>$53,250</td>
<td>$29,500</td>
</tr>
<tr>
<td>Consumable Cost/yr*</td>
<td>$7,420</td>
<td>$5,938</td>
</tr>
</tbody>
</table>

* Assuming 250 days/ year

Features & Benefits

**Longer life performance**
Excellent protection from a variety of harsh environments and contaminants

**Better coverage and protection**
Low viscosity/surface energy covers even under low profile components or irregular surfaces

**Lower production time and labor costs**
May not require curing or masking, eliminating process steps

**Greater design flexibility and improved device thinness**
Thin coatings limit thermal management issues, weight increases or changes in device thickness
For additional information visit 3m.com/datacenters or email 3MDataCenters@3m.com.

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