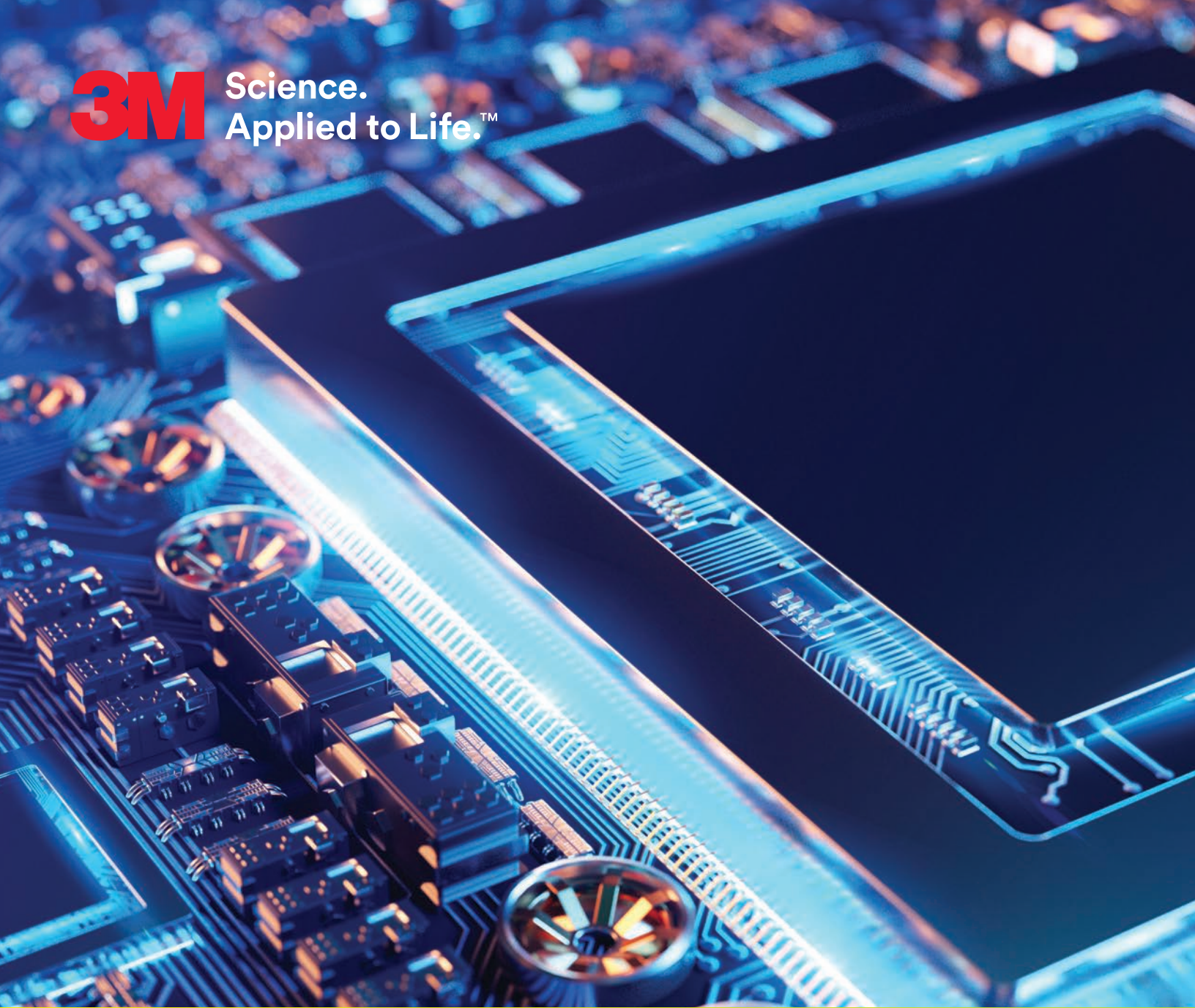




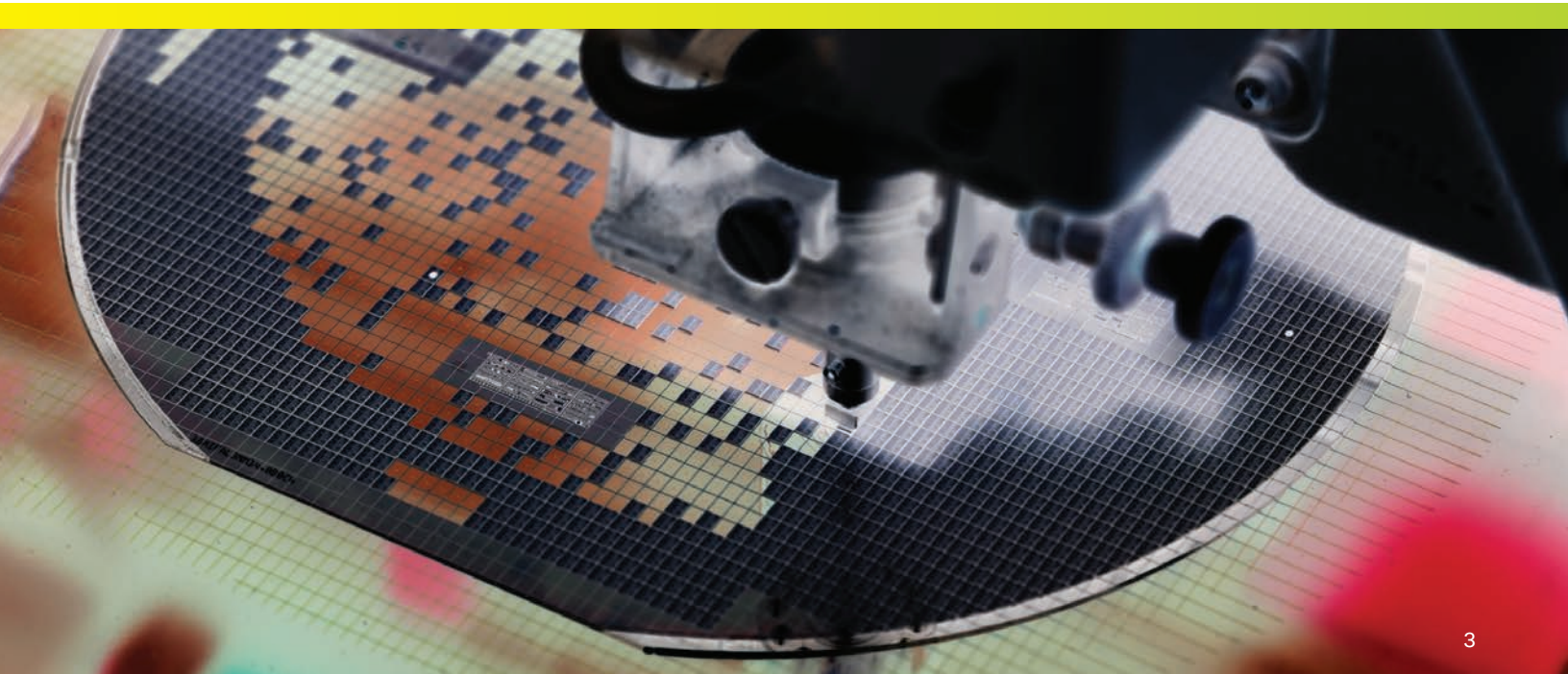
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Applied to Life.™

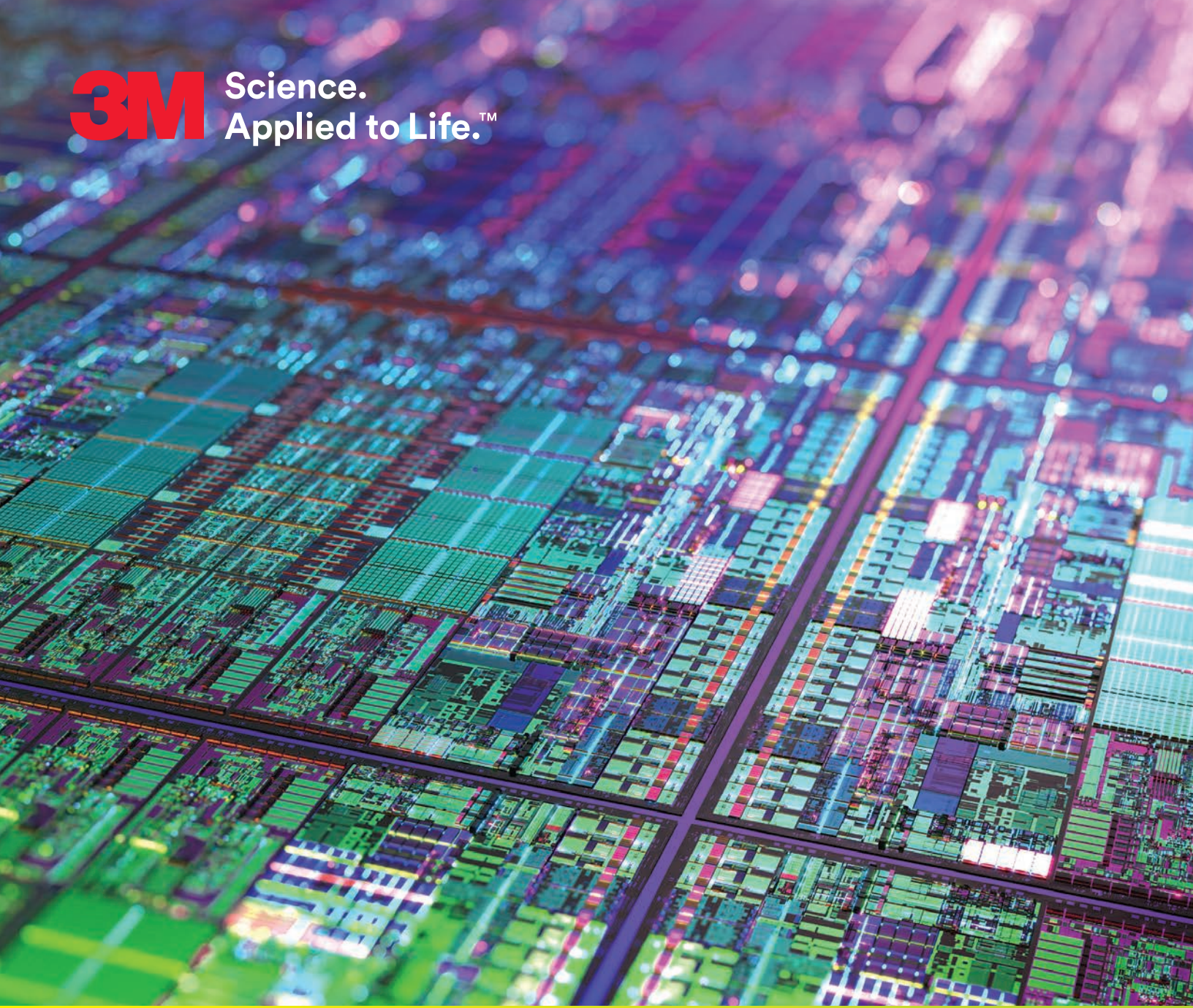


3M Semiconductor Solutions

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3M™ CMP Pad Conditioners

Redefining chemical mechanical planarization (CMP)

In the world of semiconductor fabrication, consistency, reliability and yield are critical at every part of the process. For over 25 years, 3M™ CMP Pad Conditioners have provided innovative pad conditioning solutions to some of the world's leading semiconductor fabricators.

From the exclusive sintered abrasive diamond technology behind 3M™ Diamond Pad Conditioners to the precisely microreplicated patterns in 3M™ Trizact™ Pad Conditioners, our global technical team is committed to continually redefining the cutting edge of pad conditioner technology. Multiple geographically independent research and manufacturing facilities around the world provide convenient product support and product supplies.

Selecting a pad conditioner for your application or process

Selecting a pad conditioner requires compatibility testing to ensure that your pad, wafer and slurry combination will perform optimally. Our technical team has data packages for many common processes — tungsten to copper, poly to STI, and many more — that have been proven compatible with our products over years of operation. We can also test custom combinations at our labs around the world.

Explore 3M CMP pad conditioning solutions



3M™ Trizact Pad Conditioner

Precisely engineered, microreplicated, diamond-coated ceramic CMP disks for some of the most demanding processes.



3M™ Diamond Pad Conditioner

Effective, reliable diamond pad conditioning for consistent long-term performance.



3M™ Pad Conditioner Brush

Durable, cost-effective pad conditioning for CMP buff and pad cleaning on soft pads.



3M™ Trizact Pad Conditioner T Series

Enhances the conventional 3M™ Trizact™ pad conditioner platform with a surface topography optimized for stronger pad activation, slower pad wear rate decay and even more consistent wafer-to-wafer performance.



3M™ Diamond Pad Conditioner C Series

Offers extra-precise diamond placement at the micrometer scale to further help control coplanarity and flatness for even more consistent performance in CMP pad conditioning.

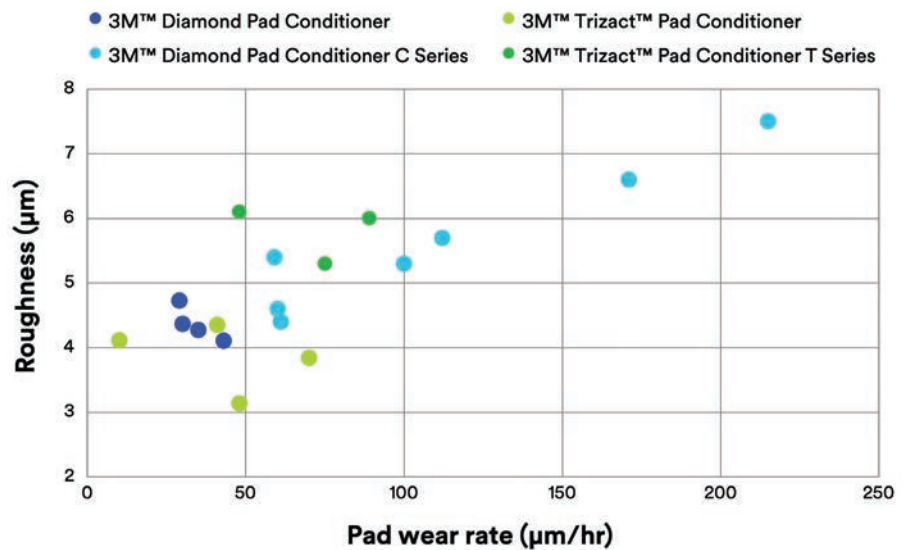
View conditioners



Matching your pad or slurry

3M offers a broad range of CMP pad conditioners tailored across key attributes such as pad wear rate and pad roughness.

Plus, our high-tech pad conditioners are designed to be compatible with CMP pads with industry-standard combinations of shore hardness and specific gravity. Data packages are available with additional product compatibility details.



This information is based on tests performed at 3M laboratory facilities, and may be based on a limited sample size or a subset of 3M CMP materials. Many factors beyond 3M's control and uniquely within the user's control can affect the use and performance of 3M CMP materials in a particular semiconductor manufacturing application. To learn more about the specific properties and benefits of a given 3M CMP pad or 3M CMP pad conditioner, or to arrange a technical evaluation of the product, contact 3M to speak with an expert.

Matching your technical needs

Across the industry, semiconductor manufacturers are facing a range of technical challenges depending on product, application and market position. Whatever your technical priority, 3M has a CMP pad conditioner for you.



Scratch and defect improvement

- 3M™ Trizact™ Pad Conditioners offer proven reductions in scratching and defectivity over legacy diamond pad conditioners, as well as providing a metal-free cutting surface for both advanced and mature nodes.
- 3M™ CMP Pad Conditioner Coatings technology enables metal leaching and defectivity improvements, and can be applied to most 3M pad conditioner products.



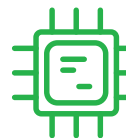
Disk-to-disk consistency

- 3M™ Diamond Pad Conditioner C Series features precision diamond placement technology and enables improved disk-to-disk consistency.
- 3M™ Trizact™ Pad Conditioners have highly controlled tip shape and height. They deliver consistency and reliability with a proven record in both advanced and mature node processes.



Cost of ownership

- 3M™ Trizact™ Pad Conditioner T Series include further improved pad wear rate decay compared with legacy pad conditioners, which helps enable cost-of-ownership improvement through longer disk life.
- 3M™ Diamond Pad Conditioner C Series features highly controlled co-planarity and flatness compared with legacy diamond pad conditioners, helping enable cost-of-ownership improvement through longer disk and pad life.



SiC and advanced packaging

- 3M pad conditioner products have been used for emerging CMP applications in SiC and advanced packaging, where large volumes of layer removal is required. 3M products help deliver long disk life with good performance to slurry corrosion, while also delivering a high removal rate through high aggressiveness.

3M™ Trizact™ Pad Conditioners

Pad conditioners for CMP processes where precision, reliability and consistency are vital. Using 3M proprietary microreplication technology, virtually every aspect from overall shape to tip shape to height dispersion can be specified at microscale and manufactured out of diamond-coated ceramic.

Get product details



Semiconductor manufacturers choose them for:



Tunable performance

Maintain tight control of your preferred height dispersion, tip shape and pattern throughout the lifespan of the pad conditioner.



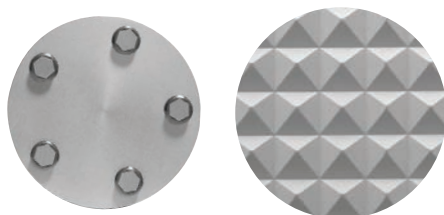
Yield improvement

Virtually eliminates scratching defects associated with some diamond grit conditioners. Controlled coefficient of variation provides optimized consistency.



Advanced node processes

No metals allowed? No problem. Ideal for processes sensitive to contamination.



Precise microreplicated patterns help give you complete process control

Frequently compatible slurry chemistries¹

- Copper
- ILD
- Poly silicon
- Self-aligned contact (SAC)
- SiGe
- STI

Explore our 3M™ Trizact™ Pad Conditioners range

View information on a few popular 3M™ Trizact™ Pad Conditioner products covering a range of roughness and pad wear rate combinations, or contact our team to explore our full library of high-performance pad conditioners.

Product Number	Carrier	Carrier Size (in.)	Abrasive Material	Feature Size, Nominal (µm)	Active Tip (% of Total) and Normalized Pad Wear Rate
A5	304 or 410 Stainless Steel	4 in. or 4.25 in.	CVD Coated Ceramic	250 µm	Available upon request
B5	304 or 410 Stainless Steel	4 in. or 4.25 in.	CVD Coated Ceramic	180 µm	Available upon request
B6	304 or 410 Stainless Steel	4 in. or 4.25 in.	CVD Coated Ceramic	180 µm	Available upon request
B25	304 or 410 Stainless Steel	4 in. or 4.25 in.	CVD Coated Ceramic	180 µm	Available upon request
B75	304 or 410 Stainless Steel	4 in. or 4.25 in.	CVD Coated Ceramic	180 µm	Available upon request

3M™ Trizact™ Pad Conditioner T Series

The epitome of our commitment to consistent, long-lifespan, metal-free pads. Launched in 2023, 3M™ Trizact™ Pad Conditioner T Series products optimize the surface topography for stronger pad activation, much slower wear and consistent performance throughout their lifetime.

Get product details



Semiconductor manufacturers choose them for:



Strong, tunable pad activation

3M™ Trizact™ Pad Conditioner T Series maintains the tunable surface topography of 3M™ Trizact™ Pad Conditioners and combines it with increased diamond grain size to strengthen pad activation.



Reduced pad wear rate

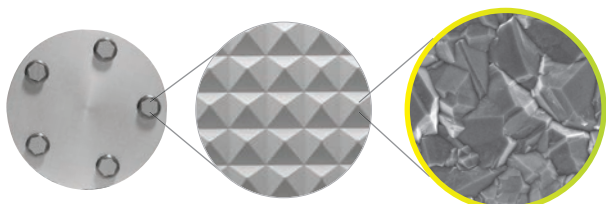
As pad conditioners wear down, the coefficient of friction (CoF) decreases, leading to pad wear rate decay. The rougher diamond coating on 3M™ Trizact™ Pad Conditioner T Series has a higher CoF that can reduce pad wear rate decay by up to 80%.



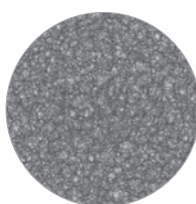
Optimized consistency

3M™ Trizact™ Pad Conditioner T Series demonstrates a coefficient of variation between pads of less than 2% — a more than 4X improvement over legacy sintered abrasive pad conditioners.

Optimized, rougher CVD diamond surface over microreplicated asperities



3M™ Trizact™ Pad Conditioner T Series



3M™ Trizact™ Pad Conditioner

Frequently compatible slurry chemistries¹

- Copper
- ILD
- Poly silicon
- Self-aligned contact (SAC)
- SiGe
- STI

Explore our 3M™ Trizact™ Pad Conditioner T Series range

View information on a few popular 3M™ Trizact™ Pad Conditioner T Series products covering a range of roughness and pad wear rate combinations or contact our team to explore our full library of high-performance pad conditioners.

Product Number	Carrier	Carrier Size (in.)	Abrasive Material	Feature Size, Nominal (µm)	Active Tip (% of Total) and Normalized Pad Wear Rate
B5T	304 or 410 Stainless Steel	4 in. or 4.25 in.	CVD Coated Ceramic	180 µm	Available upon request
B6T	304 or 410 Stainless Steel	4 in. or 4.25 in.	CVD Coated Ceramic	180 µm	Available upon request
B25T	304 or 410 Stainless Steel	4 in. or 4.25 in.	CVD Coated Ceramic	180 µm	Available upon request

3M™ Diamond Pad Conditioners

3M™ Diamond Pad Conditioner products feature a diamond grid firmly attached through 3M proprietary sintered abrasive technology. These reliable pad conditioners can help refresh your CMP pad surfaces, minimize wear, and maintain consistent asperities and consistent pad performance, for wafer after wafer.

Get product details



Semiconductor manufacturers choose them for:



Controlled performance

Diamond spacing and protrusion results in excellent pad planarity.



Increased life

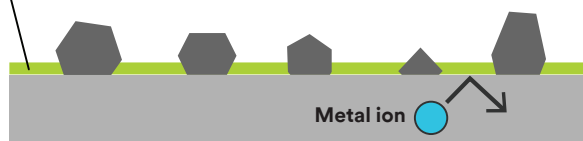
Diamonds are firmly secured with 3M proprietary sintered abrasive technology and protected by an edge exclusion zone to minimize scratching and uneven wear.



Responsive support and supply

Four geographically independent 3M manufacturing and research facilities around the world provide prompt, local technical support and supply.

3M™ CMP Pad Conditioner Coating



3M™ CMP Pad Conditioner Coatings reduce metal leaching

3M™ CMP Pad Conditioner Coatings put a durable layer over the pad conditioner, helping substantially reduce metal leaching. Plus, they further minimize micro and macro scratching defects. 3M coatings can be factory-applied to any 3M™ Diamond Pad Conditioner.

Explore our 3M™ Diamond Pad Conditioners range

See next page for details.

View details on selected 3M™ Diamond Pad Conditioners covering a range of roughness and pad wear rate combinations or contact our team to explore our full library of more than 70 high-performance pad conditioners.

Frequently compatible slurry chemistries¹

- BPSG
- Cobalt
- Copper
- ILD
- Metal gate
- Poly silicon
- STI
- Tungsten

Explore our 3M™ Diamond Pad Conditioners range

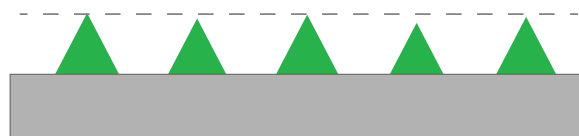
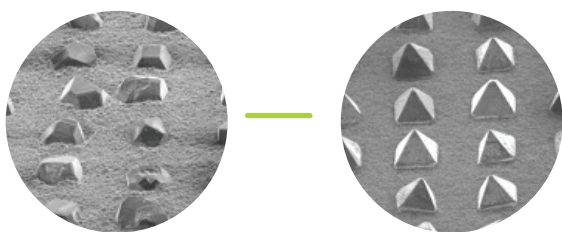
Product Number	Carrier	Carrier Size (in.)	Diamond Size (µm)	Diamond Type*	Flatness (µm)	Aggressiveness Value (BL)
A63	304 Stainless Steel	4.25 in.	63 µm	2	0-35.5 µm	1-3
A82	304 Stainless Steel	4.25 in.	74 µm	2	0-60 µm	6-14
A98	304 Stainless Steel	4.25 in.	90 µm	3	1-70 µm	8-14
A122	304 Stainless Steel	4.25 in.	150 µm	3	43-96 µm	9-16
A153L	304 Stainless Steel	4.25 in.	150 µm	4	1-100 µm	6-9
A160	304 Stainless Steel	4.25 in.	250 µm	4	1-100 µm	15-19
A165	304 Stainless Steel	4.25 in.	250 µm	4	1-100 µm	15-19
A188	Polycarbonate	4.25 in.	250 µm	4	1-100 µm	15-19
A188H	Polycarbonate	4.25 in.	250 µm	4	10-90 µm	20-26
A188J	Polycarbonate	4.25 in.	250 µm	4	1-100 µm	15-19
A189H	304 Stainless Steel	4.25 in.	250 µm	3	0-75 µm	22-28
A189L	304 Stainless Steel	4.25 in.	250 µm	3	0-75 µm	14-16
A2813	304 Stainless Steel	4.25 in.	180 µm	3	0-75 µm	20-27
A3700	Polycarbonate	4.25 in.	150 µm	9	1-100 µm	25-35
B138L	410 Stainless Steel	4 in.	180 µm	1	25-60 µm	18-25
H70 (Double sided)	304 Stainless Steel	3.74 in.	63 µm	2	1-100 µm (on both sides)	N/A
L130	410 Stainless Steel	4 in.	150 µm	3	20-57 µm	9-12
S60	410 Stainless Steel	4 in.	250 µm	4	50-100 µm	15-19
S82	410 Stainless Steel	4 in.	74 µm	2	20-71 µm	9-10
S122	410 Stainless Steel	4 in.	150 µm	3	21-69 µm	9-16
S122H	410 Stainless Steel	4 in.	150 µm	3	21-69 µm	13-16
S122L	410 Stainless Steel	4 in.	150 µm	3	21-69 µm	9-12
S188J	410 Stainless Steel	4 in.	250 µm	4	20-60 µm	15-19

*Higher numbered diamond types are sharper (e.g. Type 2: Blocky, Type 3: Semi-Blocky, Type 4: Semi-Sharp)

3M™ Diamond Pad Conditioner C Series

3M™ Diamond Pad Conditioner C Series products take the next step in consistency and control for diamond pad conditioners. Building on our tested and reliable sintered abrasive technology for diamond attachment, 3M™ Diamond Pad Conditioner C Series positions each diamond in a grid pattern at the micrometer scale. Plus, we've further controlled co-planarity and flatness so that you can have confidence in your activated pad roughness over dozens or hundreds of wafers.

Get product details



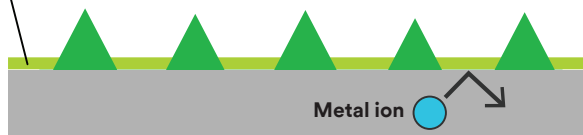
Exceptionally controlled performance

3M manufacturing processes emphasize consistency and precision. We can orient the diamonds on 3M™ Diamond Pad Conditioner C Series with a more than 80% tip-up ratio.

Highly controlled co-planarity

Choose your grid density. Precision diamond placement improves your control of pad wear rate and enables improved disk-to-disk consistency.

3M™ CMP Pad
Conditioner Coating



**3M™ CMP Pad
Conditioner
Coatings
reduce metal
leaching**

Frequently compatible slurry chemistries¹

- BPSG
- Cobalt
- Copper
- ILD
- Metal gate
- Poly silicon
- STI
- Tungsten

Explore our 3M™ Diamond Pad Conditioner C Series range

View details on select 3M™ Diamond Pad Conditioner C Series products, or contact our team to explore our full library of products.

Product Number	Carrier Type and Size (in.)	Diamond Size (µm)	Pitch (µm)
C250	304 Stainless Steel 4.25 in., 410 Stainless Steel 4 in.	250 µm	510 µm
C260	304 Stainless Steel 4.25 in., 410 Stainless Steel 4 in.	250 µm	625 µm
C280	304 Stainless Steel 4.25 in., 410 Stainless Steel 4 in.	250 µm	884 µm
C2120	304 Stainless Steel 4.25 in., 410 Stainless Steel 4 in.	250 µm	1250 µm
C2160	304 Stainless Steel 4.25 in., 410 Stainless Steel 4 in.	250 µm	1667 µm



3M™ Flexible Pad Conditioner

Long-lifetime, low-defect CMP pad conditioning and cleaning

3M™ Flexible Pad Conditioner is a transformative solution to the unique challenges of conditioning and texturing CMP pads.

Constructed of a durable unibody polymer, it pushes beyond the limits of traditional diamond pad conditioning to enable a new level of customization and performance, including:

- **Tunable Design:** Bristles, design and material that can be tuned to the hardness and structure of your pad, including a broad range of options tested for compatibility with industry standard pads.
- **Helps Reduce Defects:** Enables low-debris cutting followed by effective pad pore cleaning.
- **Long Lifespan:** Stable removal rate and performance throughout the pad lifetime.

Advancing conditioner innovation

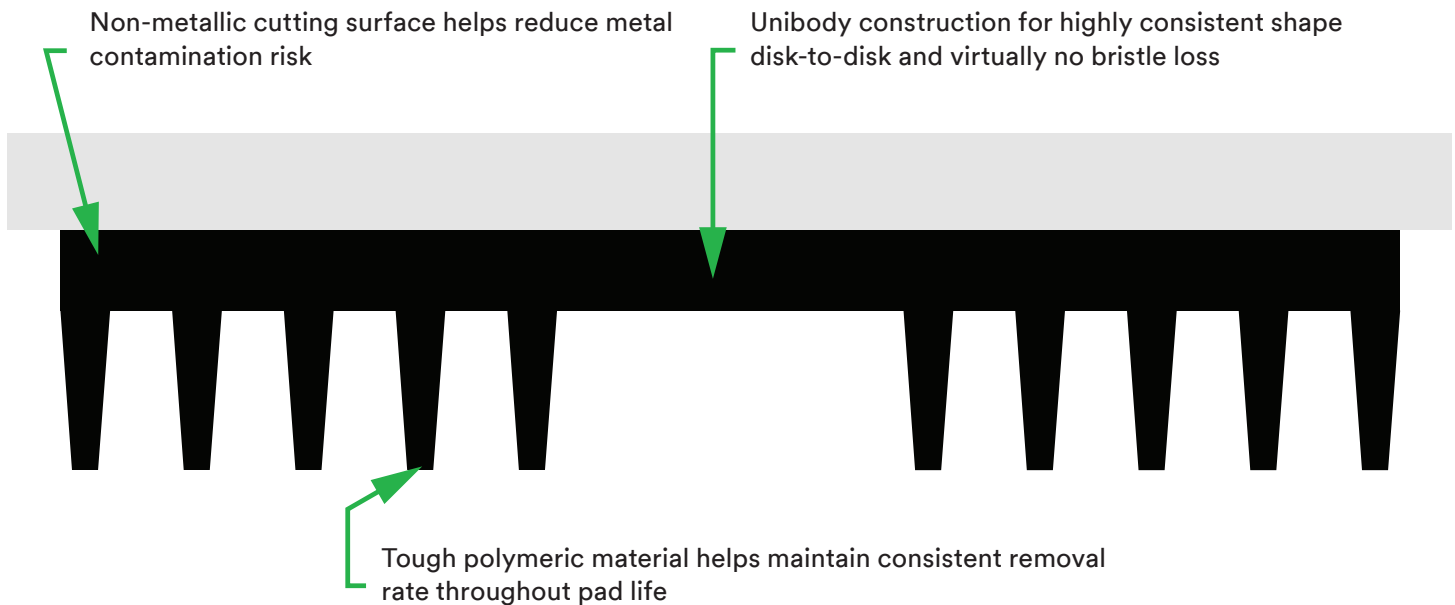
High porosity, tight defect tolerances, and modern slurries pose a new set of challenges to CMP pad conditioning and cleaning.

With 3M™ Flexible Pad Conditioner, 3M has combined the quick pad break-in time and powerful conditioning performance of diamond pad conditioners with the effective defect performance of brushes.

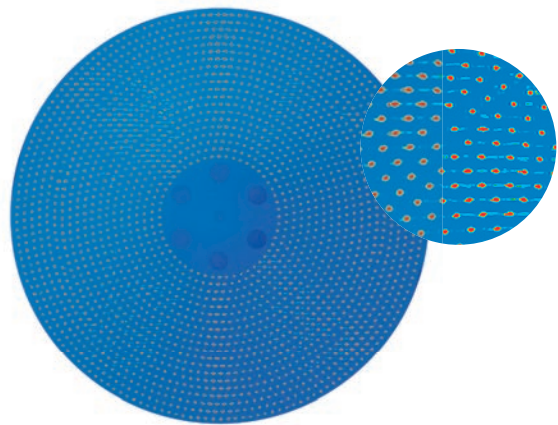
Learn more about the unique benefits it offers for maintaining your CMP pad performance over time.

About 3M™ Flexible Pad Conditioner

Exceptional construction

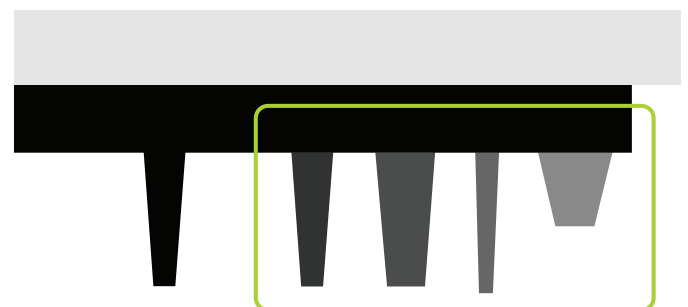


Controlled and consistent number of working bristle tips



High-resolution image analysis shows that nearly all bristle tips (shown in red) will make contact with the pad surface, helping enable very consistent conditioning performance during the disk lifetime. In addition, the tightly controlled manufacturing process helps reduce disk to disk variability in working bristle tips to a minimum.

Tunable material hardness and bristle shape



Select your preferred bristle hardness and shape from 3M's library of options, to enable customized interactions tuned for your pad and process.

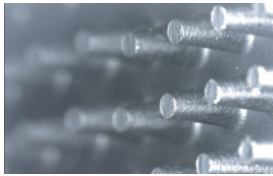
Pad conditioning and texturing applications



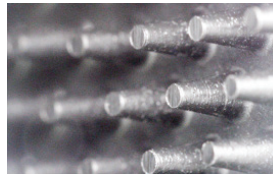
Quick Break-in, Long Lifespan

- **Quick Break-in:** Initial aggressiveness helps enable speedy pad break-in.
- **Staying Power:** Minimal bristle wear over time.

Before pad use



After pad use



Improved Defect Performance

- **Smaller Debris:** Average debris size 5-10X smaller than diamond pad conditioners.
- **Efficient Slurry Distribution:** Very efficient at distributing slurry and moving debris away from the pad.
- **No Diamond Scratching:** The toughened polymer used in 3M™ Flexible Pad Conditioner is very durable and resistant to fracturing
- **No Metal Contamination:** Non-metallic cutting surface. The carrier can also be coated for additional protection.

Pad cleaning applications



Easy to Clean

- Optimized spacing minimizes trapped slurry and debris compared to conventional brushes.
- Tunable bristle material is easier to clean with water than conventional products.



Efficient Slurry Transport

- Tunable bristles are highly efficient at transporting slurry and debris.
- Testing shows low accumulation of ceria, cationic silica and other difficult-to-clean slurries.



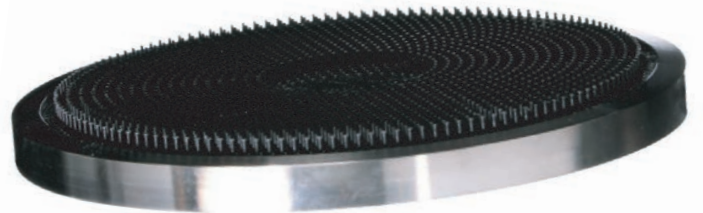
Virtually No Bristle Breakage

- Tough unibody polymer materials are optimized for near zero breakage.



Consistent Bristle Contact

- Controlled and consistent number of working bristles compared to conventional brushes.



3M™ Flexible Pad Conditioner benefits and compatibility

Additional Benefits

Total Cost of Ownership

Longer pad lifespan and reduced defects compared to conventional diamond disks can help you improve your overall cost performance.

Compatibility

Pads

- Soft and ultra-soft pads, particularly poromeric and low modulus pads
- 3M™ Trizact™ CMP Pads

Processes

- Cu Barrier
- Cu BPR
- Metal buff
- Dielectric buff
- Wafer cleaning/pre-clean modules
- Others in testing

Coatings

All 3M™ CMP Pad Conditioner Coatings can be applied to the carrier for additional protection.

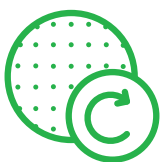
3M™ CMP Pad Conditioner Brush

Featuring a metal-free construction and low cost of ownership, 3M™ CMP Pad Conditioner Brush products are used for CMP buff and pad cleaning applications.

Get product details



Semiconductor manufacturers choose them for:



Great for soft CMP pads

Strong bristles to remove pad debris from porometric and felt-based pads.



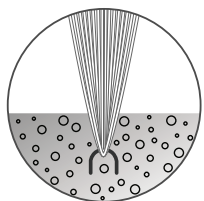
Metal-free durability

Bristles are independently anchored and evenly distributed across the brush surface using 3M proprietary brush-making technology.

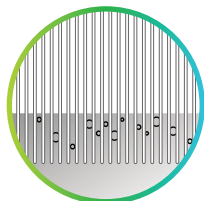


Low cost of ownership

Efficient pad cleaning and slurry distribution.



Conventional tufted bristle brush



3M™ CMP Pad Conditioner Brush

Pad cleaning and gentle conditioning of soft CMP pads

Frequently compatible pads¹

- Felt-based pads
- Porometric pads

Explore our 3M™ CMP Pad Conditioner Brush range

View information on select popular 3M™ CMP Pad Conditioner Brush products covering a range of fiber lengths, densities and diameters, or contact our team to explore our full library of products.

Product Number	Carrier	Brush Material	Carrier Size (in.)	Fiber Length (in.)	Nominal Fiber Density (mg/cm ²)	Fiber Diameter (in.)
PB32A	Polycarbonate	Nylon	4.25 in.	0.21 in.	82	0.005 in.
PB33A	Polycarbonate	Nylon	4.25 in.	0.21 in.	82	0.005 in.
PB33R	Polycarbonate	Nylon	3.15 in.	0.21 in.	82	0.005 in.
PB42A	Polycarbonate	Nylon	4.25 in.	0.15 in.	68	0.005 in.
PB52A	Polycarbonate	Nylon	4.25 in.	0.34 in.	200	0.012 in.



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Applied to Life.™

3M™ Trizact™ CMP Pads

3M™ Trizact™ CMP Pads: Redefining CMP.

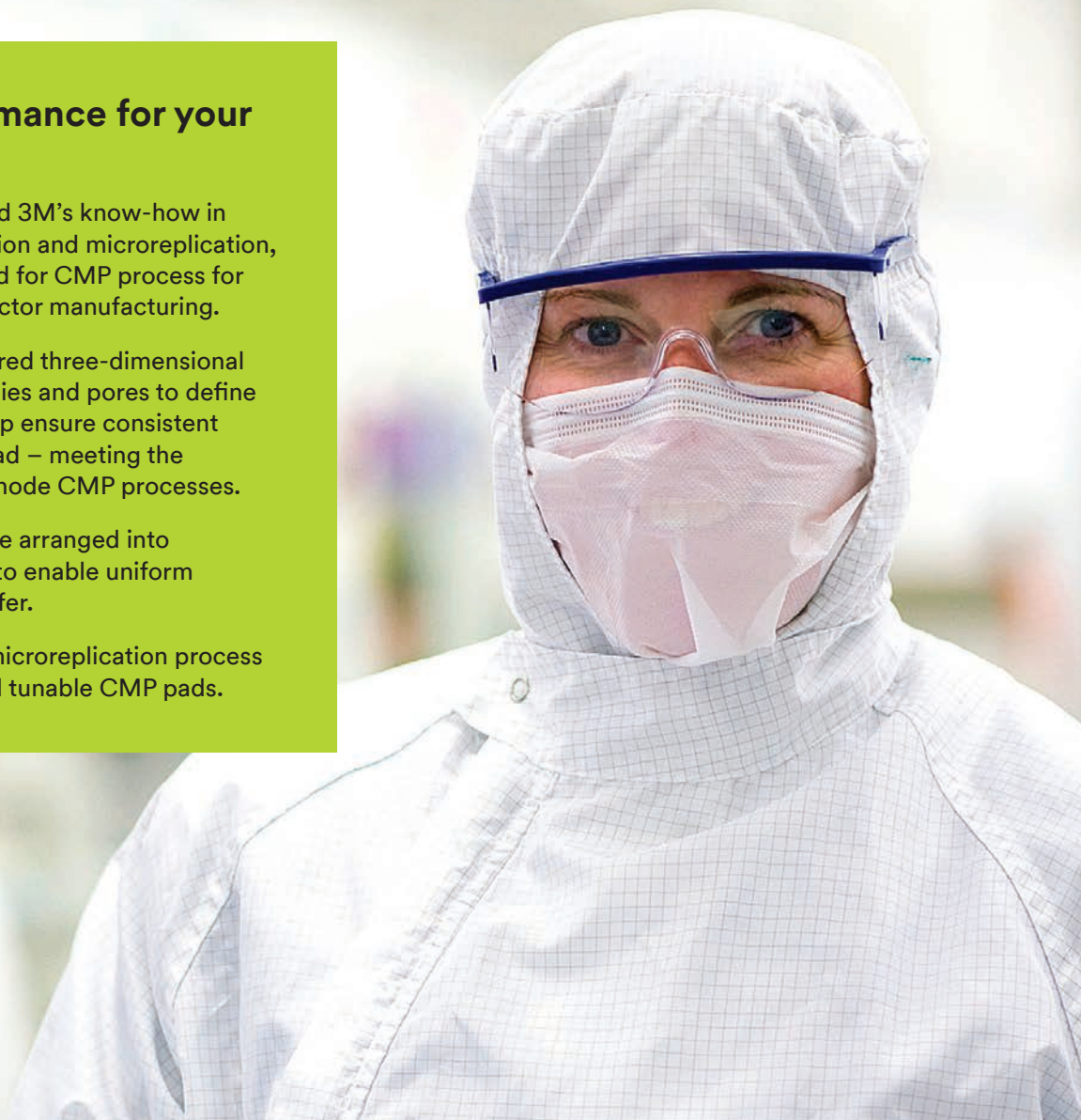
Designed to deliver predictable, stable, consistent performance to your Chemical Mechanical Planarization process – every time.


With trends like IoT, smart cities, connected transportation, mobile and edge computing driving our world, semiconductor devices that deliver more memory and speed are in demand. The pressure is on to improve performance and cost-effective consistency of the Chemical Mechanical Planarization (CMP) process of semiconductor manufacturing. Demand to continually increase yield leaves no room for variation in a fab's production that risks waste or device reliability. 3M is redefining CMP products with our 3M™ Trizact™ CMP Pads to help ensure consistent CMP process performance.

Advanced performance for your advanced nodes.

Our Trizact CMP Pads blend 3M's know-how in molding, surface modification and microreplication, delivering an innovative pad for CMP process for advanced node semiconductor manufacturing.

- Uses precisely engineered three-dimensional microreplicated asperities and pores to define the pad texture and help ensure consistent performance pad-to-pad – meeting the demands of advanced node CMP processes.
- Asperities and pores are arranged into independent unit cells to enable uniform pressure across the wafer.
- Our highly controlled microreplication process delivers repeatable and tunable CMP pads.





Innovative groove design of the 3M™ Trizact™ CMP Pad with independent unit cells — shown here as an optical microscope image.

Reduced variability and increased repeatability – helping to deliver improved yield.

Consistency.

Designed to deliver the CMP performance you need, 3M™ Trizact™ CMP Pads are engineered using our proprietary microreplication process. The result is a pad that is consistent and well characterized, helping to ensure that tomorrow's pad is the same as today's.

- Uniformity in the polishing process
- Consistent texture from pad to pad
- Stability through pad life

Improved yield.

Consistent and repeatable CMP performance helps lead to increased yield. Trizact CMP Pads help increase planarization efficiency, reduce defects, and improve productivity and output.

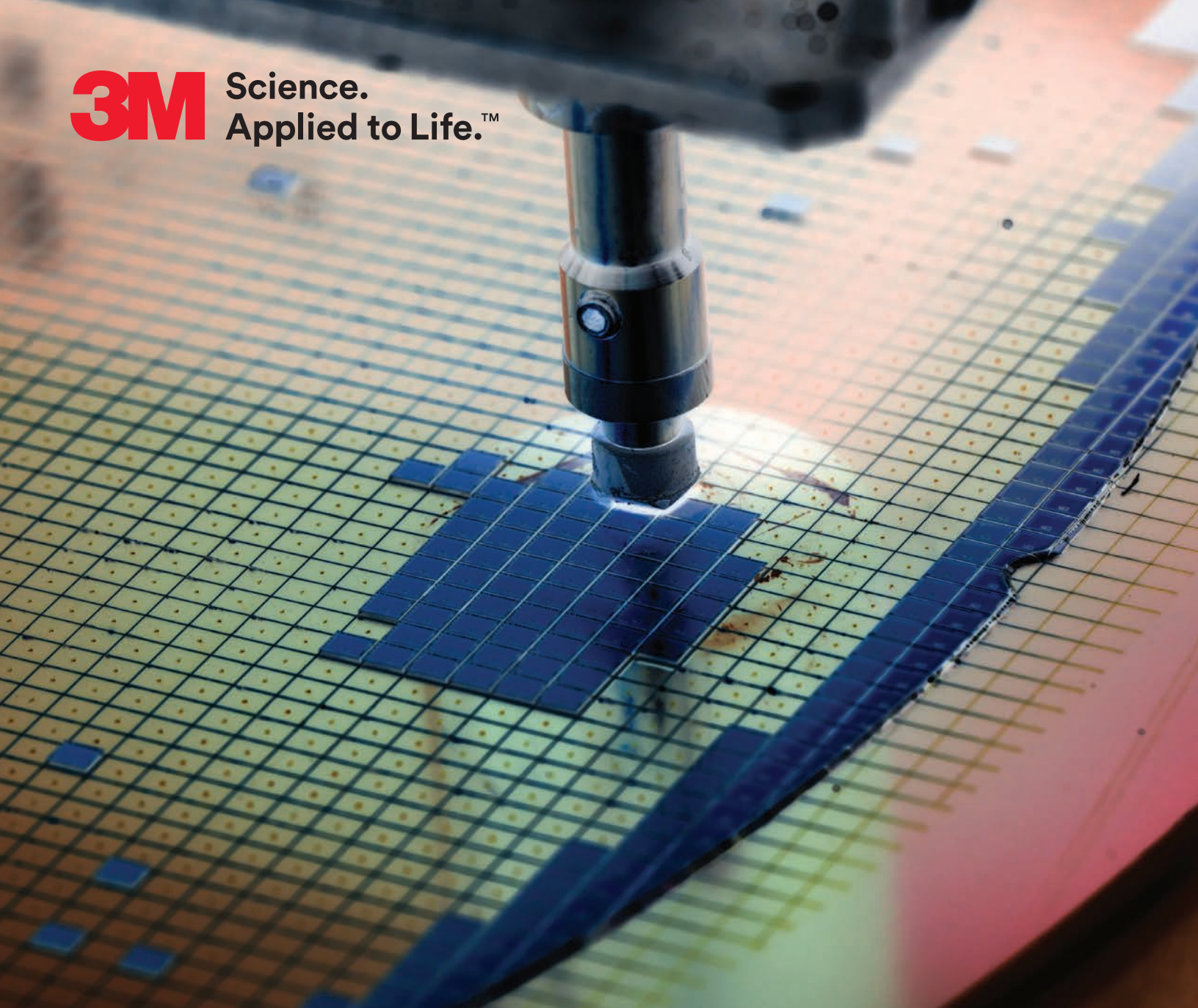
- Improved planarization efficiency to enable advanced node CMP
- Reduced dishing and erosion
- Less pad debris for fewer defects

Reduced consumables.

Our proprietary approach to microreplication helps to deliver a longer pad life and eliminates the need for a diamond pad conditioner.

- Reduced metal contamination risk
- Lower cost of ownership
- Longer life, less downtime

Visit us at [3M.com/TrizactCMP](https://www.3M.com/TrizactCMP) to learn more and connect with our experts.



3M™ Pad Bonding Tapes

3M™ Double Coated Tape for CMP Pad Attachment

Products for Pad to Platen Attachment

Since 1980, various types of 3M™ Double Coated Adhesive Transfer Tapes have been developed and used to attach polishing pads to the platen in the chemical mechanical planarization (CMP) industry. The most commonly used products are the family of 3M™ Double Coated Tapes 442, due to their chemical resistance and easy removal ability from the platen. With the increased demand on service life and chemical resistance of various types of slurries, new double coated tapes have been developed to meet these stringent requirements. The following table provides a list of 3M™ Double Coated Tapes currently in use in the CMP industry to attach polishing pads to platens. For detailed performance information, please refer to the product Technical Data Sheets.



3M™ Double Coated Tapes 442

3M™ Double Coated Tape	Manufacturing Location	Carrier Type	Carrier Thickness (mils)	Liner A Thickness (mils)	Liner B Thickness (mils)	Liner Type (Single or Dual)	Liner Type (Paper/PET)	Jumbo Width Offered (")	Feature
442F	US	PET	1	3	N/A	Single	PET	Up to 60"	Rubber adhesive, clean removal
442KW	US	PET	1	4.5	N/A	Single	Paper	Up to 60"	Rubber adhesive, clean removal
458PLD	US	PET	1	4.3	1	Dual	Paper (Embossed)	Up to 62"	Rubber adhesive, with micro-channel on the surface to avoid air trap
442JS	JP	PET	1	4.1	N/A	Single	Paper	Up to 80"	Rubber adhesive, clean removal
442JSDL	JP	PET	1	4.1	1.97	Dual	Paper/PET	Up to 53"	Rubber adhesive, clean removal
442JA	JP	PET	1	4.1	N/A	Single	Paper	Up to 64"	Single side rubber adhesive, single side acrylic adhesive
442JSK	JP	PET	1	4.1	N/A	Single	Paper	Up to 53"	Rubber adhesive, stable tack

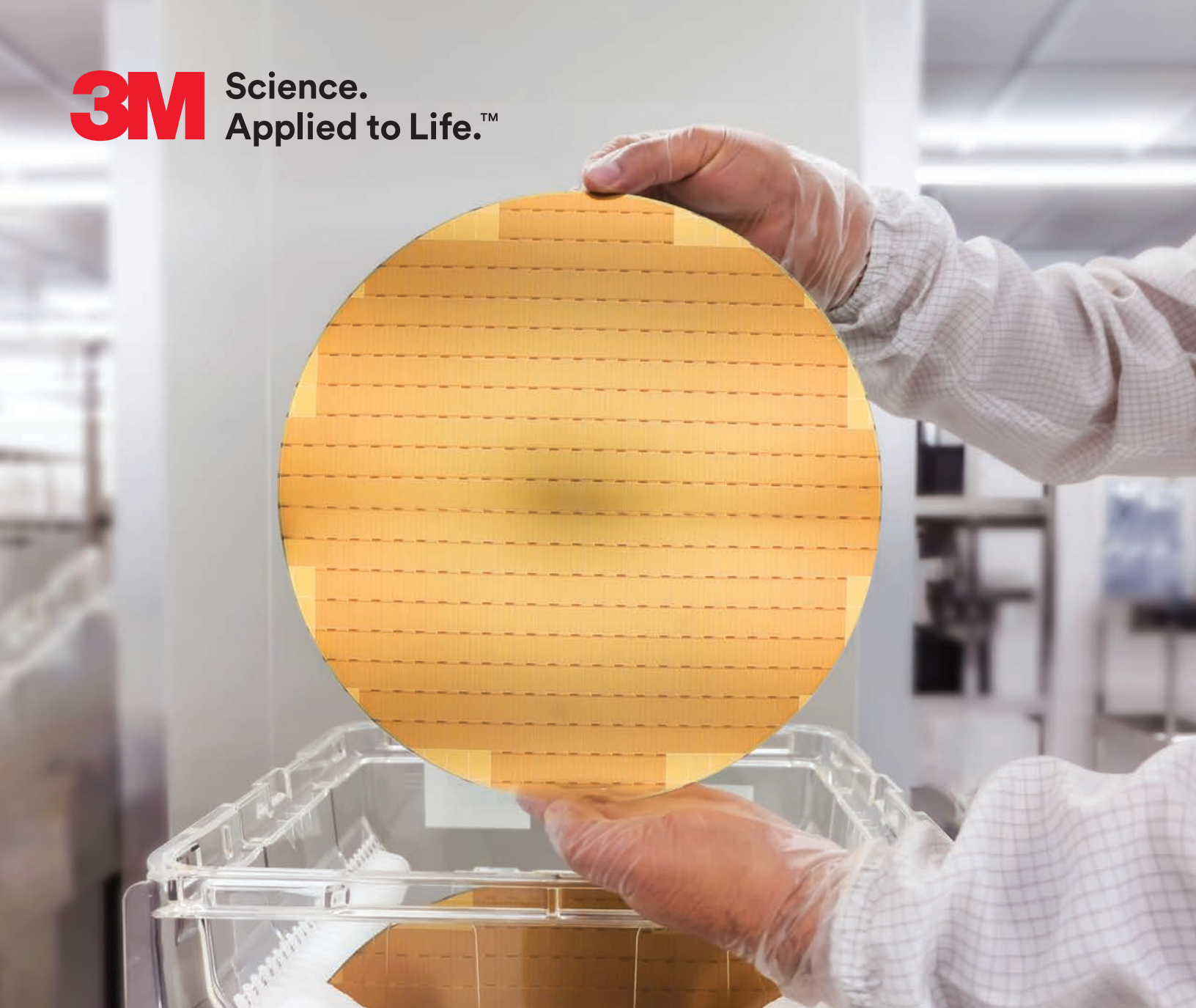
Products for Pad to Pad Attachment

3M™ Double Coated Tape PBT539 is a semiconductor wafer manufacturing tape designed for bonding and debonding during the semiconductor wafer manufacturing process. A CMP tape, 3M™ Double Coated Tape PBT539 features a thin polyester film carrier for dimensional stability and excellent handling with ease of die cutting and laminating. It comes with 3M™ Adhesive 360 on either side, an acrylic-based adhesive that bonds to most surfaces, including high-surface-energy and low-surface-energy materials.



3M™ Double Coated Tape PBT539

3M™ Double Coated Tape	Carrier Type	Carrier Thickness (mils)	Faceside Adhesive (mils)	Backside Adhesive (mils)	PET Release Liner (mils)	Feature
PBT539	PET	2	3.5	3.5	3	Easy handling, clean removal



3M Advanced Packaging Solutions

3M semiconductor advanced packaging solutions

Optimize current advanced packaging processes or take your manufacturing to the next level with advanced packaging bonding solutions from 3M. Materials for temporary bonding/debonding and process protection can help handle and protect wafers and key components during intense processing steps, so you can have more design flexibility, reduce costs and improve yield.

What is semiconductor advanced packaging?

Advanced packaging is a term for specific methods of packaging chips. The key difference in advanced versus traditional packaging is how chips are connected to enable high device density and expanding functionality in a smaller footprint. Through-silicon vias (TSVs), bridges, interposers, or wires are used to form larger connections, resulting in increased signal speed and less energy consumption. Methods include fan-out wafer-level packaging (FOWLP), fan-out panel-level packaging (FOPLP), heterogeneous integration, 2.5D, 3D-IC, embedded die in substrate and system-in-package (SiP), among others.



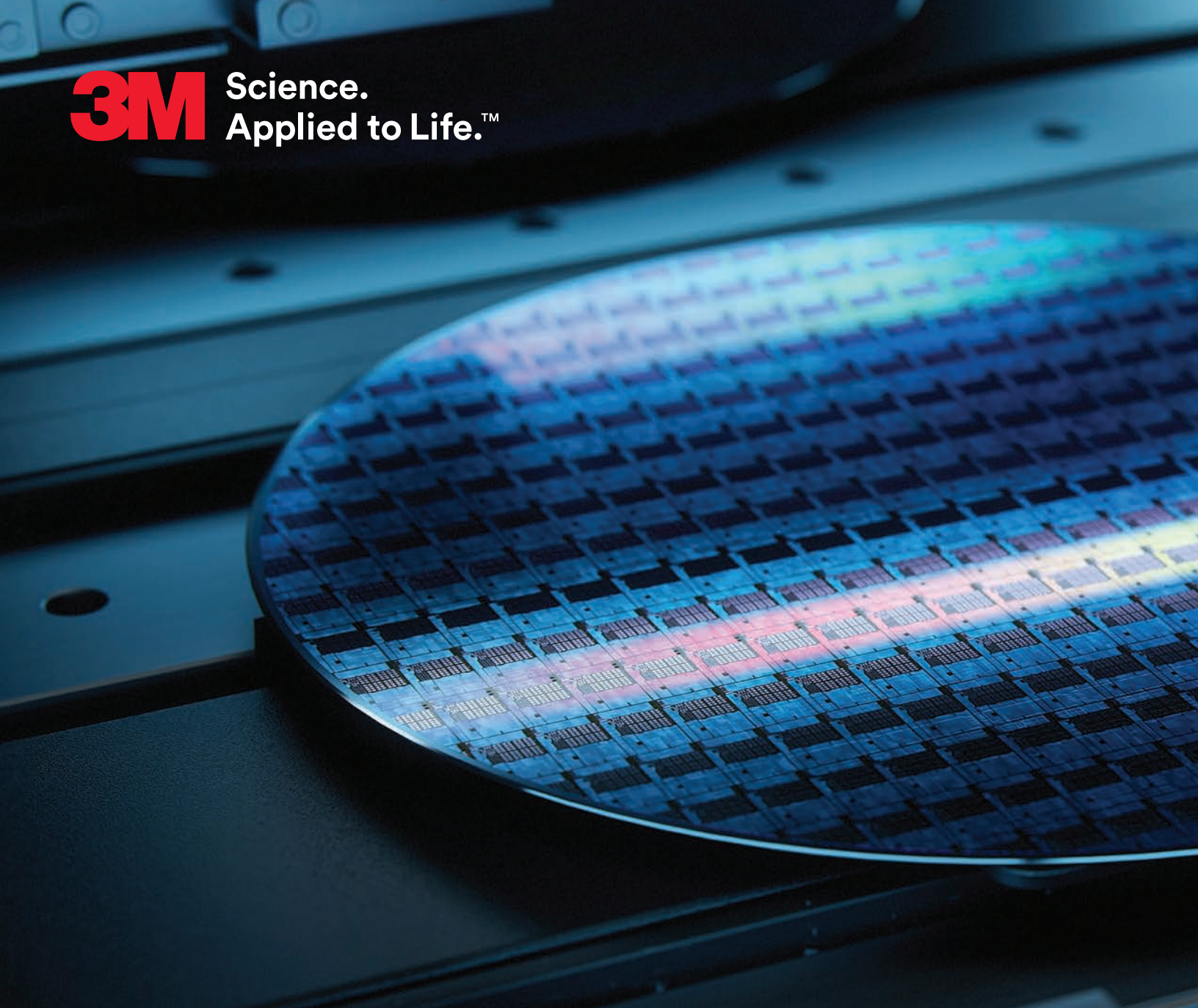
Temporary bonding and debonding

See better consistency and improve yield from wafer- and panel-level packaging and related processes with existing and future 3M temporary bonding and debonding solutions. 3M strives to offer materials with excellent thermal stability, chemical resistance to varying process chemistries, and easy removal.



Process protection

When complex surfaces require specialized adhesives for process protection, 3M solutions are ready to go to work. Our adhesive products are intended to offer exceptional protection during high-temperature processes and are anticipated to increase efficiency in wafer bumping.



3M™ Wafer Support System

Helping Semiconductor Fabricators Sustain Yields with the 3M™ Wafer Support System

The 3M™ Wafer Support System (WSS) is a complete, cost-effective temporary bonding and debonding solution for high-volume wafer manufacturing needs including IGBT ultrathin silicon, silicon carbide, and advanced packaging.

Through the combination of a temporary bonding adhesive, a release layer, and an adhesive removal tape, it helps semiconductor fabricators enable new stacked wafer designs and more effective fan-out packaging processes.

Adhesives undergo strict adhesion, thermal and chemical resistance testing, so they can withstand critical process, time, temperature and substrate requirements.



Improved Yield

Less warpage, cracking and edge chipping



High Throughput

Up to 22 wafers per hour



Thin Wafers

Effective down to 20 micron wafer thickness



Wafer Processing Compatibility

Works with high temperature/high vacuum processes, common chemistries and low-k film formation processes



Globally Adopted Solution

More than 150 high-volume WSS tools are currently in service, processing millions of ultrathin wafers per month



Recyclability

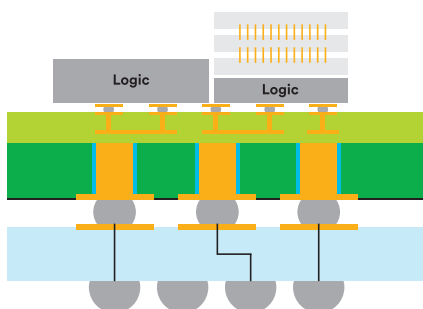
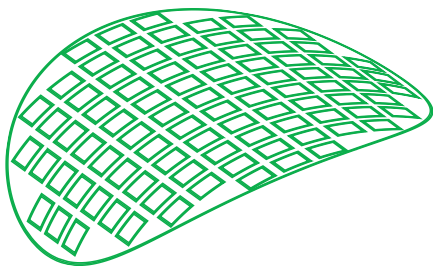
Up to 2/3 of uncured 3M™ UV-Curable Adhesive LC-3200 used in wafer coating can be recycled by the tool, reducing waste



Room Temperature Bonding

No need for heat or chemicals

Applications



Power Semiconductor Devices

- **Ultrathin Silicon** – As silicon wafer processing moves to 300mm diameter and simultaneously shrinks to just a few tens of microns thick, maintaining stability during processing is essential.
- **Silicon Carbide** – Silicon carbide (SiC) ICs are one of the components at the heart of electric vehicles and other power devices. SiC wafers are both very hard and very brittle, posing unique processing challenges.

Advanced Packaging

Increasing device density integration in an even smaller footprint calls for thinner and thinner wafers. Technologies include:

- **Fan-out wafer-level packaging (FOWLP)** – Processed wafers are diced and carefully rearranged on a wafer, which is molded to fill gaps. The spaces where gaps have been filled create “fanned out” connection networks.
- **Heterogeneous integration** – Heterogeneous integration takes different components (die, MEMS, sensors, etc.) that have been manufactured in separate processes and combines them into a single overall package. This package can deliver better functionality and operational benefits (system-level performance, ownership costs).

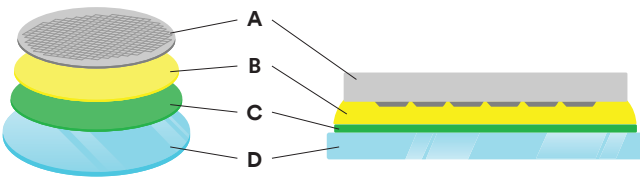
How the 3M™ Wafer Support System Works

When a silicon or silicon carbide wafer is undergoing delicate processes like fan-out wafer-level or panel-level packaging (FOWLP or FOPLP), it needs a rigid, uniform support surface which will help minimize stress on the wafer during important processing steps and which can then easily be removed.


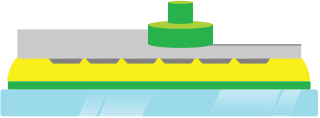
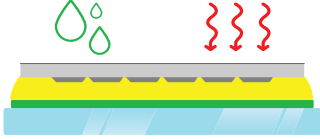


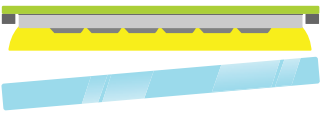

The 3M™ Wafer Support System quickly bonds the wafer to a glass carrier. The carrier and bonding adhesive fully support the wafer throughout processing, and their good heat and chemical resistance are compatible with a wide variety of processing steps.

Once processing is complete, the 3M™ Wafer Support System can be quickly and easily debonded with minimal wafer stress and no extra cleaning.

Understanding the Process Flow



- A. Semiconductor wafer
- B. 3M™ Liquid UV-Curable Adhesive
- C. 3M™ Light-to-Heat Conversion Release Coating (LTHC Ink)
- D. Glass carrier
- E. 3M™ Wafer De-Taping Tape 3305 (see Step 7 below)

Process Step		Benefits
1 Bond the wafer to glass carrier		<ul style="list-style-type: none"> Quick adhesive curing with UV exposure Room temperature curing Excellent conformity to surface topography Up to 2/3 of uncured LC-3200 adhesive can be recycled by the tool
2 Backgrinding		<ul style="list-style-type: none"> Good total thickness variation (TTV) after backgrinding (typically 2µm TTV for 300mm wafer) Wafer fully supported throughout the process
3 Backside processing		<ul style="list-style-type: none"> Good heat resistance (up to 260°C/266°F, for 1 hour) Good chemical resistance to a broad range of process chemistries Low outgas
4 Dicing tape application		
5 Laser debonding		<ul style="list-style-type: none"> Compatible with 308, 355, 532 and 1064nm lasers Room temperature process No chemicals necessary Low wafer stress
6 Glass carrier lift-off		<ul style="list-style-type: none"> Room temperature, chemical-free carrier separation, great for fragile substrates Reusable carrier
7 Peel off UV adhesive layer		<ul style="list-style-type: none"> Low wafer stress High throughput No post-peel cleaning

A Complete End-to-End Solution

The 3M™ Wafer Support System is a single complete solution consisting of a temporary bonding adhesive, a release layer, and an adhesive removal tape. There are several temporary bonding adhesives available for different viscosities and low-, medium- and high-temperature process needs.

Adhesive	Product Name	Base Resin	Viscosity	Recommended Application
	3M™ UV-Curable Adhesive LC-3200	Acrylic	3500 CP @25°C	Low Temperatures (60+ min @ 150°C; several min @180°C)*
	3M™ UV-Curable Adhesive LC-4200	Acrylic, functional polymer	2150 CP @25°C	Intermediate Temperatures (90 min @180°C; several min @ 200°C)*
	3M™ UV-Curable Adhesive LC-5320	Special acrylate	2500 CP @25°C	High Temperatures (60+ min @260°C; several min @300°C)*

*Thermal performance varies by wafer construction. Wafer evaluations should be used to validate performance in process.

Release Layer	Product Name	Composition	Color	Features
	3M™ Light-To-Heat-Conversion (LTHC) Release Coating	Thermoplastic resin	<i>In Solution:</i> Black <i>As Coating:</i> Semi-transparent grey	Enables clean release of adhesive/glass bond

Adhesive Removal	Product Name	Backing	Adhesive	Standard Roll Length	Tape Thickness	Features
	3M™ Wafer De-Taping Tape 3305	Polyester	Rubber	100 meters	2.7 mils	High instant adhesion. Allows for smooth unwind of roll.

Learn more at 3M.com/WaferSupportSystem



3M™ Heat Resistant Polyimide Process Tapes



Product Selection Guide

3M™ Heat Resistant Polyimide Tapes feature thermally cross linkable acrylic adhesives on heat resistant polyimide backings. This provides good initial adhesion combined with less adhesion build up after high temperature molding or reflow processes, as well as clean removal performance. These tapes are for masking, protection and carrier applications in semiconductor manufacturing.

3M™ Heat Resistant Polyimide Process Tapes									
Product Number	7418F	7418E	7421	7418S	7418S-22	7416Y	7414	7414-5	7414L-5
Key Performance Features	Clean removal after reflow processes. Strong adhesion during heat process on molding, Polyamide or LCP materials with low surface energy.	Clean removal after reflow processes. Strong adhesion during heat process on molding, Polyamide or LCP materials with low surface energy. Electrostatic discharge (ESD) properties on the polyimide backing layer to avoid chip toss off issue.	Clean and easy removal after molding or die embedding processes under high temperature. Good adhesion during high temperature embedding processes to avoid die shifting.	Clean removal after reflow processes. Strong adhesion during heat process on molding or LCP surfaces with low surface energy.	Clean removal after reflow processes. Strong adhesion during heat process on molding or LCP surfaces with low surface energy.	Clean removal after molding processes. Reduced adhesion after heat processes for easy removal.	Clean removal after reflow processes. Good adhesion during heat process on molding or glass surfaces.	Clean removal after reflow processes. Good adhesion during heat process on molding or glass surfaces.	Clean removal after reflow processes. Good adhesion during heat process on molding or glass surfaces.
Typical Application	Masking	Masking	Molding (Embedded Die in Package, Leadframe)	Masking	Masking	Molding (Leadframe)	Masking	Masking	Masking
Backing	Polyimide	Polyimide	Polyimide	Polyimide	Polyimide	Polyimide	Polyimide	Polyimide	Polyimide
Adhesive	Acrylic	Acrylic	Acrylic	Acrylic	Acrylic	Acrylic	Acrylic	Acrylic	Acrylic
Primary Liner	Polyester (Silicone PET)	Polyester (Silicone PET)	Polyester (Silicone PET)	Polyester (Silicone PET)	Polyester (Silicone PET)	Polyester (Silicone PET)	None	None	Polyester (Non-Silicone PET)
Temperature Range	-40°C to 260°C	-40°C to 260°C	-40°C to 260°C	-40°C to 260°C	-40°C to 260°C	-40°C to 260°C	-40°C to 260°C	-40°C to 260°C	-40°C to 260°C
Adhesion to Stainless, 23°C/30min	1.6 N/cm	1.6 N/cm	0.1 N/cm	0.8 N/cm	1.1 N/cm	0.7 N/cm	0.5 N/cm	0.3 N/cm	0.3 N/cm
Adhesion to Stainless, 210°C/60min	2.1 N/cm	2.1 N/cm	0.3 N/cm	1.8 N/cm	2.0 N/cm	0.3 N/cm	1.2 N/cm	1.2 N/cm	1.2 N/cm
Adhesion to Stainless, 260°C/10min	1.7 N/cm	1.7 N/cm	0.3 N/cm	1.4 N/cm	1.6 N/cm	0.2 N/cm	1.1 N/cm	1.2 N/cm	1.2 N/cm
Tensile Strength at Break	280 MPa	280 MPa	280 MPa	280 MPa	280 MPa	280 MPa	280 MPa	280 MPa	280 MPa
Adhesive Thickness	22 µm	22 µm	6 µm	17 µm	22 µm	5 µm	22 µm	5 µm	5 µm
Total Tape Thickness without Liner	47 µm	47 µm	31 µm	42 µm	47 µm	30 µm	47 µm	30 µm	30 µm
Total Tape Thickness	85 µm	85 µm	69 µm	80 µm	85 µm	68 µm	47 µm	30 µm	30 µm
Electrostatic Discharge (ESD)	None	1×10 ⁹ Ω/sq. (Backing side)	None	None	None	None	None	None	None

DISCLAIMER: Product Selection Guide use: This tool is intended to provide guidance on choosing a polyimide process tape products. Since there are many factors that can affect a product's use, the customer and user remain responsible for determining whether the 3M product is suitable and appropriate for the user's specific application, including user evaluating the 3M product in user's application. We recommend getting in touch with your local 3M Technical Sales Representative at 3M.com/semiconductor

3M™ Trizact™ Composite Slurry and Pad Products

Supporting you at every step.

3M™ Trizact™ Composite Slurry and Pad Products for lapping and finishing

When it comes to ensuring the quality of semiconductor and display wafers, the solutions you use for lapping and finishing are critical in achieving the tightest specifications in the latest generation electronics and chips. 3M™ Trizact™ Composite Slurry and Pad products not only gets you quality products that help at every step of the lapping and finishing process, but the peace of mind that comes with knowing our team of engineers and application experts are ready to help you integrate them into your manufacturing process.

Trizact composite slurry and pad products come in a variety of grades, each suited to a different wafer type (silicon carbide or sapphire) and process step:

TCSP Slurry Portfolio by Process Step

Application	Trizact Grade	Product	Substrate	Removal Rate (RR)	Surface Finish (Ra)	Common Pad Used
Lapping	Medium	Trizact Composite Slurry DT-100, D	Sapphire Silicon carbide	1.5	15	HT-800-PC
Rough Lapping	Coarse	Trizact Composite Slurry DT-100, G	Sapphire Silicon carbide	1.8	25	HT-800-PC
Rough Lapping	Coarse	Trizact Composite Slurry DT-50, G	Sapphire	1.3	21	HT-800-PC
Fine Lapping	Fine	Trizact Composite Slurry DE-100, PF*	Silicon carbide	0.9	9	G4E*
Pre-CMP	Ultrafine	Trizact Composite Slurry DE-100, 4XS*	Silicon carbide	0.2	< 2	G4E*

- Medium and coarse grade products are applicable to sapphire and silicon carbide
- Fine and ultrafine grades slurries are used primarily for silicon carbide finishing

	Trizact Composite Slurry DE-100, 4XS*	Trizact Composite Slurry DE-100, PF*	Trizact Composite Slurry DT-100, D	Trizact Composite Slurry DT-100, G
Trizact grade	Ultrafine	Fine	Medium	Coarse
Removal rate (RR)	Low	Medium	High	High
Finish	Mirror	Good	Medium	Medium
Application	Pre-CMP	Fine lap	"Rough" lap	"Rough" lap

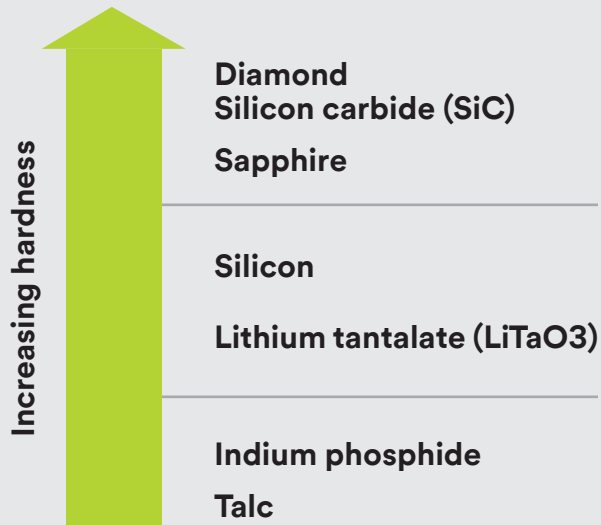
*Experimental

A simpler alternative.

3M™ Trizact™ Composite Slurry and Pad Products were developed as an alternative to the copper composite platen and diamond slurry process (Cu DMP). Some of the advantages include:

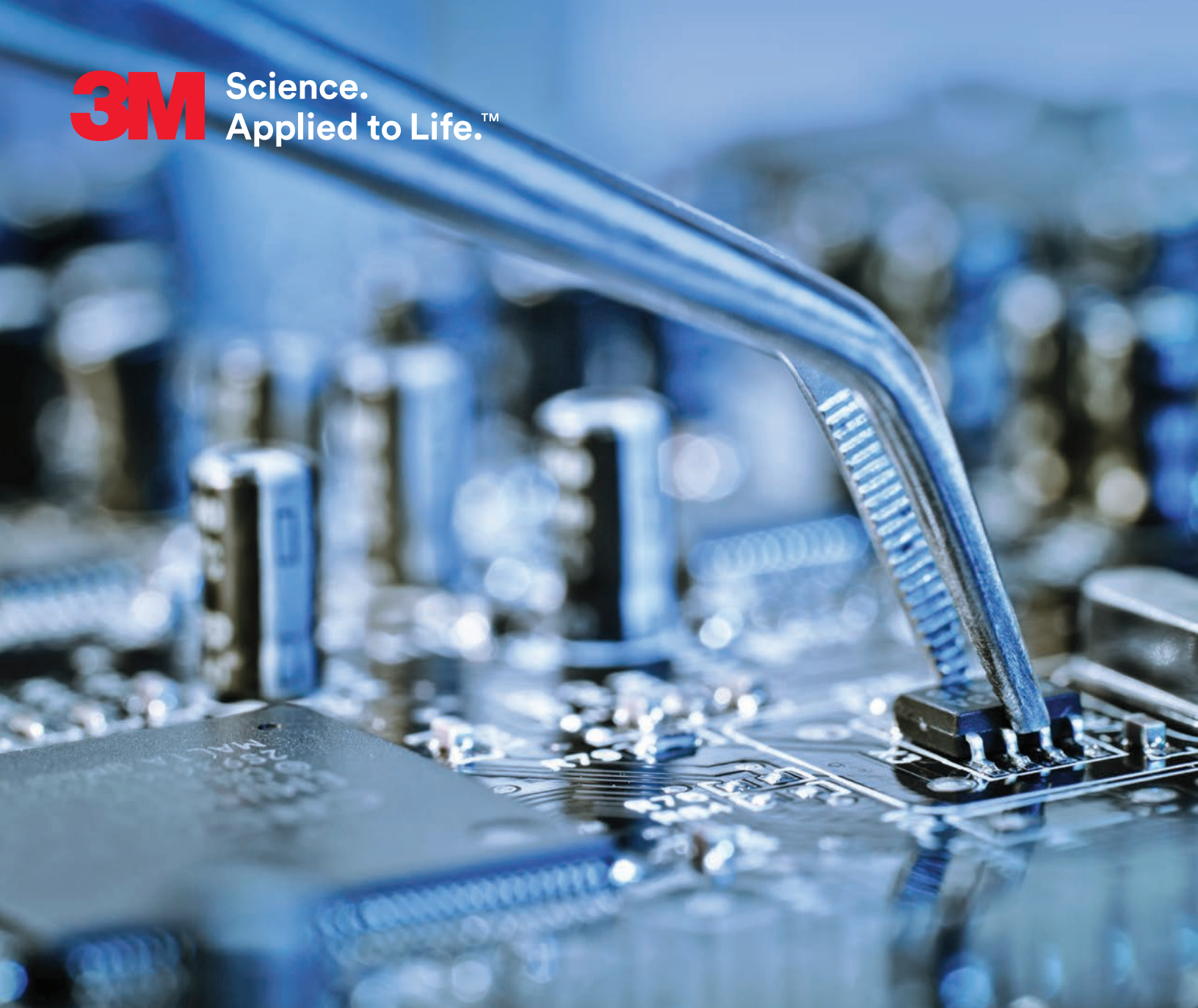
- No need to re-groove copper platen
- Improved Total Thickness Variation (TTV)
- Improved productivity due to double-sided pad
- No copper in polishing waste
- High Removal Rate (RR) with good surface finish
- Ease of use

When to use 3M™ Trizact™ Composite Slurry and Pad Products



- Works best on crystalline materials like sapphire, silicon carbide, etc.
- Substrate hardness/brittleness dictates pad and slurry type (e.g. “softer” LiTaO3 substrate works best with G4E pad)
- Different pads and slurry type for the various finishing steps in substrate finishing
- Best results achieved immediately after wire saw; i.e., minimizes number of steps in the finishing process





3M™ Carrier Tapes and Cover Tapes for Semiconductor Transport

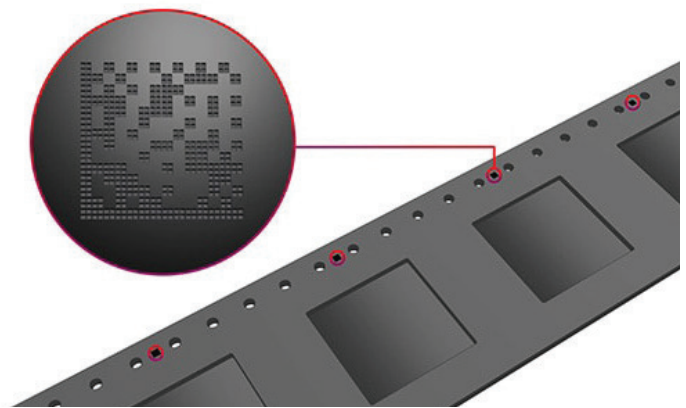
3M™ Polycarbonate Carrier Tapes

Miniaturized component packages, with their potential for chip sticking and migrating, pose real challenges in tape and reel transport. At the same time, effective process and throughput management is essential. 3M offers carrier tapes with tolerances as low as 0.02 mm, pocket control to less than <0.1 mm, smaller D1 hole sizes down to 0.01 mm and flat bottom surfaces with small draft angles. We can also add barcodes directly to the tape, so you can improve defect analysis, limit chip loss and potentially reduce process steps. These capabilities are fully compatible with 3M cover tapes, and can improve productivity in automated pick and place assembly operations.



3M™ Polycarbonate Carrier Tape 3000R – open radius

Packaging technologies such as WLCSP, fan out, multi-stack assemblies and others lead to thin and small designs. To meet design trends, 3M offers raised-platform 3M™ Polycarbonate Carrier 3000R Series carrier tape technology that minimizes die rotation, tilting and chip migration as well as component damage and waste that can occur when using thin and small designs in tape-and-reel formats. Excellent for small die designs, 3M carrier tapes allow semiconductor manufacturers to control pocket opening radii within <0.1 mm. Such tight controls help chips stay in place, limiting chipping and cracking, and maximize throughput and yield.



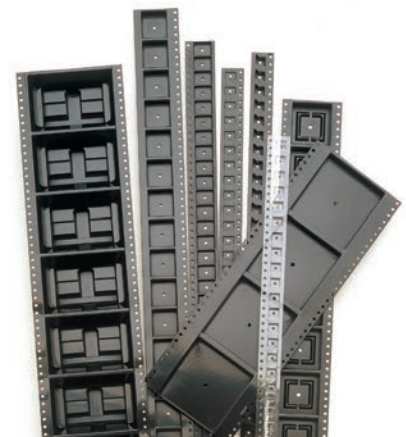
3M™ Polycarbonate Carrier Tape 3002 – barcode application

Through our proprietary 2D barcode technology, 3M can pre-apply a high-fidelity 2D barcode to each pocket of precision-formed tape. 3M™ Polycarbonate Carrier 3002 Series, 2D Barcode tape is based on laser technology. The barcodes are applied to the tape instead of the chips, helping to greatly reduce the chance of chip or connection damage due to lasering. This product can save time since the usual laser coding step can be skipped. 3M™ Polycarbonate Carrier 3002, 2D Barcode technology also helps provide traceability for bare dies in stacking processes like 3D-stacked High Bandwidth Memory (HBM) design, helping increase the percentage of Known Good Dies (HGDs) delivered to the stacking stage.



3M™ Polycarbonate Carrier selection guide

Safe and secure transport between the stages of the semiconductor fabrication process is critical for maximizing chip and chiplet yield. As chips architecture evolves to 2D, 2.5D and 3D in pursuit of smaller footprint, better power management and overall performance, the risks to chip integrity during transportation are significant due to the complex architecture. 3M™ Polycarbonate Carrier tapes are available in a range of precision manufactured designs and solutions to help minimize die migration and cracking and to help reduce pick-up failure. Plus, these tapes are available in transparent form, are compatible for clean room use and can offer additional features such as traceability that meet the needs of your manufacturing processes. Explore our range of solutions, or find out more by contacting a 3M™ Carrier Tape expert.



Properties	Unit	2703	2705	3000 (3000NB)	3000R	3002	3200
Opening R	mm	NA	NA	0.18~0.25*	<0.10 (for W=8 mm) <0.12 (for W>12 mm)	0.18~0.25*	0.18~0.25*
Tolerance (A ₀ , B ₀ , K ₀)	mm	± 0.10	± 0.10	± 0.05 & ± 0.10 ± 0.03 (U series) ± 0.02 (X series)	± 0.05 ± 0.03 (U series) ± 0.02 (X series)	± 0.05 & ± 0.10 ± 0.03 (U series) ± 0.02 (X series)	± 0.05 & ± 0.10 ± 0.03 (U series) ± 0.02 (X series)
K ₀ range	mm	0.33 ~ 6.00	0.33 ~ 6.00	0.20 ~ 6.00	0.14 ~ 0.25	0.20 ~ 6.00	0.20 ~ 6.00
D1 diameter	mm	1	1	D1 minimum <0.15	D1 minimum <0.15	D1 minimum <0.15	D1 minimum <0.1
Surface resistance	ohm	Non-conductive	1.0*10 ⁸ ~ 1.0*10 ¹¹	1.0*10 ⁴ ~ 1.0*10 ¹¹	1.0*10 ⁴ ~ 1.0*10 ¹¹	1.0*10 ⁴ ~ 1.0*10 ¹¹	1.0*10 ⁴ ~ 1.0*10 ¹¹
Additional Features							
Transparent	-	✓	✓				
Clean room compatible	-			Optional (BD, UB series)	Optional (BD, UB series)	Optional (BD, UB series)	Optional (BD, UB series)
Raised platform (height)	-			Optional (BD, UB series)	Optional	Optional	Optional
Raised cross bar (height)	-			Optional	Optional	Optional	Optional
Traceability	-					✓	

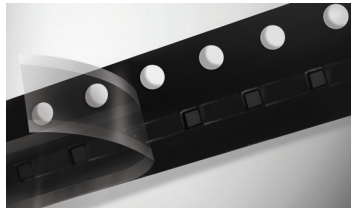
* Typical performance

3M™ Cover Tapes

3M™ Cover Tapes seal into 3M™ Embossed Carrier Tapes to help protect electrical and electronic components during transport and storage. Our cover tapes offer excellent sealing properties and smooth peel force to help ensure efficient SMT pick and place operations. The full line of cover tapes includes non-conductive and static dissipative products with heat activated (HAA) or pressure sensitive adhesives (PSAs).



Heat Activated (HAA)



Pressure Sensitive (PSA)



Universal Cover Tape (UCT)

Product Category	Resistivity Features (Ohms)	Adhesive Type	Haze (%)	Clarity (%)	Features	Recommended Applications
3M™ Static Dissipative Heat Activated Cover Tape 2671A	Back side: 10^6 to 9.9×10^{11} Component side: 10^5 to 9.9^9	Heat Activated (HAA)	26	73.8	<ul style="list-style-type: none"> Standard, Narrower SR range compare to other HAA Better aging performance 	Discrete, IC, LED, Passive, WLCSP
3M™ Static Dissipative Heat Activated Cover Tape 2675	Back side: 10^8 to 10^{11} Component side: 10^8 to 10^{11}		29.5	80.6	<ul style="list-style-type: none"> Low peel force 	Discrete, IC, LED, Passive, WLCSP
3M™ Static Dissipative Heat Activated Cover Tape 2677	Back side: 10^8 to 10^{12} Component side: 10^6 to 10^{10}		16	87	<ul style="list-style-type: none"> No bubble issue, Small peeling force range, Good clarity 	
3M™ Static Dissipative Heat Activated Cover Tape 2678	Back side: 10^8 to 10^{11} Component side: 10^8 to 10^{11}		13.6	92.4	<ul style="list-style-type: none"> Good clarity HAA Cover Tape 	
3M™ Static Dissipative Heat Activated Cover Tape 2690 (NEW)	Back side: 2.2×10^{10} Component side: 2.9×10^8		13	90.1	<ul style="list-style-type: none"> Improved heat resistance sensitivity for chip stick prevention Good clarity and haze Good sealing and stable peel force 	WLCSP, bare dies and ultra thin packages
3M™ High Shear Pressure Sensitive Cover Tape 2668	Back side: Non Conductive Component side: 10^4 to 10^{10}	Pressure Sensitive (PSA)	5.7	91.7	<ul style="list-style-type: none"> Flat surface sealing, Smaller peel range 	Discrete, IC, LED, Passive, WLCSP
3M™ Universal Cover Tape (UCT) 2688A	Back side: Non Conductive Component side: 10^5 to 10^{10}		2.4	84	<ul style="list-style-type: none"> Innovative peeling design with repeatable tracks and score lines to remove only the center part of the cover tape Smooth peeling performance with a tight range, helping reduce vibration and component movement 	WLCSP, bare dies and ultra thin packages

Important Notice and Disclaimer

Safety Data Sheet: Consult Safety Data Sheet before use.

Regulatory: For regulatory information about this product, contact your 3M representative.

Technical Information: The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

Product Use: Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application.

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