3M Science. Applied to Life.™

Control your EMI with confidence.

3M™ EMI/RFI Management Solutions

EMI management solutions for critical electronics.

When it comes to improving the reliability of critical electronics, EMI/RFI control is vital. Any interference can disrupt sensitive systems, potentially causing malfunctions or failures that could jeopardize electronic operations. With decades of experience in EMI and EMI control innovation, we've put our material science to work to provide solutions for the unique challenges of harsh environments.

Product engineering expertise: Choose between commercial off-the-shelf (COTS) and custom-tailored products made to your specifications.

- Decades of EMI/RFI experience and innovation to provide reliable, high-quality solutions that are cost-effective and easy to use
- Intimate understanding of A&D ecosystem and requirements
- Please consult 3M sales if AS9100 is required

Lab support: Be confident you're getting the durability and reliability you need from our materials with our extensive testing capabilities.

- Simulation and modeling
- Shielding effectiveness measurement
- Permeability and permittivity measurements
- Reliability testing for age, humidity and temperature cycling
- And more

Supply chain support: We're here to support you through the manufacturing process and beyond

- Many trusted converter and channel partners worldwide with AS9120 certification and ITAR compliance
- Cost-effective solutions with longer shelf life options available
- Flexible and responsive order fulfillment

Providing our military customers with solutions for reliable and effective designs potentially minimizing interference.

Why is minimizing EMI/RFI important?

When the amount of noise (EMI) increases relative to the signal's strength, resulting in a low signal-to-noise ratio (SNR), this can degrade equipment performance or even lead to potential failure of performance.

3M™ EMI/RFI Management Solutions will help you:

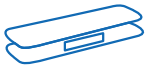
- Minimize EMI noise and crosstalk
- Enhance signal integrity and reliability
- Optimize SWaP design characteristics with thin and lightweight materials
- Achieve quick and easy application with peel and stick solutions
- Create a quick and cost-effective custom stack-up with commercial off-the-shelf solutions

Generated by electronic devices, communications signals, electromagnetic frequencies and static electricity, Electromagnetic Interference (EMI) – also known as Radio Frequency Interference (RFI) – is a spurious radiated or conducted emission that can interfere with the performance of electronic components and RF systems within electronic equipment.

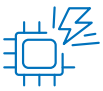
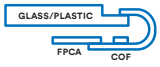
Help increase device reliability with 3M™ EMI/RFI Management Solutions

When you're looking to improve reliability of your equipment – avionics, radar and other critical electronics – EMI shielding and absorbing materials can help minimize errors, data loss, delayed readings, or potential failure. Our solutions are used to help reduce internal EMI from within devices, external EMI from nearby electronics, and radiated emissions.

EMI Absorbing Applications

 Cable wrapping/ attachment	 Attached to noise (traces, IC's, reflective enclosure surface)	 Attached to metal surface (reduce emitting EMI noise)
 Near field communication	 Attached to semicon chip/ micro-processors	 Insert between module (compartment)

EMI Shielding and Grounding Applications

 Flex circuit to flex circuit interconnection	 Camera module grounding	 Electrostatic discharge (ESD)	 Shield can lid	 PCB/flex/chassis grounding
 PIM management	 Sensor grounding	 EMI shield and gasket attachment	 Bond line gap shielding	 FPC grounding
 Shielding display wrap	 Display chip on flex			

3M™ EMI Absorbers

3M™ EMI Absorbers are flexible composite materials that incorporate specialized magnetic particles and an optional non-conductive PSA to absorb near-field EMI. They help protect nearby electronics from EMI by suppressing EMI noise at multiple frequencies. 3M absorbers are available with a wide range of performance characteristics for effective EMI management, including a variety of thicknesses, resin systems, temperature ranges, a sheet and roll format, and with and without adhesive. These thin, highly permeable magnetic absorbers help reduce EMI noise, help improve the signal-to-noise ratio for better system performance in some of the most extreme environments, and help enable thinner, lighter solutions.

Features and benefits

- Absorbing capabilities up to 10GHz with targeted permeability up to 10GHz
- Customization available
- Absorbing performance is thickness dependent (ex. 200MHz to 4GHz for 3M absorber EM25TP)
- Helps improve antenna performance and reduce EMI interference within a device
- Multiple thicknesses and optional adhesive to create a custom stack-up
- Longer shelf life options available (up to 2 years)
- Supplied on a removable liner for easy handling
- Halogen free*

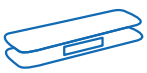
Product Usage

- Electronic enclosure noise suppression
- Antenna sidelobe reduction
- Radar absorbing
- Surface wave absorption
- Satellite module EMI control
- ADAS component absorbing

Applications

Cable wrapping/ attachment

Attached to semicon chip/ micro-processors



Insert between module (compartment)

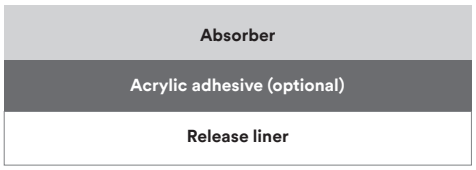
Attached to noise (traces, IC's, reflective enclosure surface)

Product construction

3M EMI Absorber & Magnetic Shielding Materials

AB3000
Operating frequency: 1GHz – 10GHz

EM25TP
Operating frequency: 200MHz – 4GHz

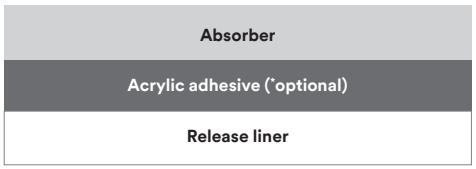


3M EMI Absorbers

AB5000HF, AB5000SHF
Operating frequency: 300MHz – 2GHz

AB7000E, AB7000HF
Operating frequency: 300MHz – 4GHz

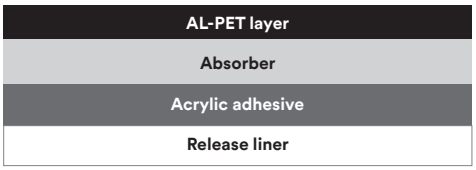
AB8000 (high temp)
Operating frequency: 300MHz – 4GHz



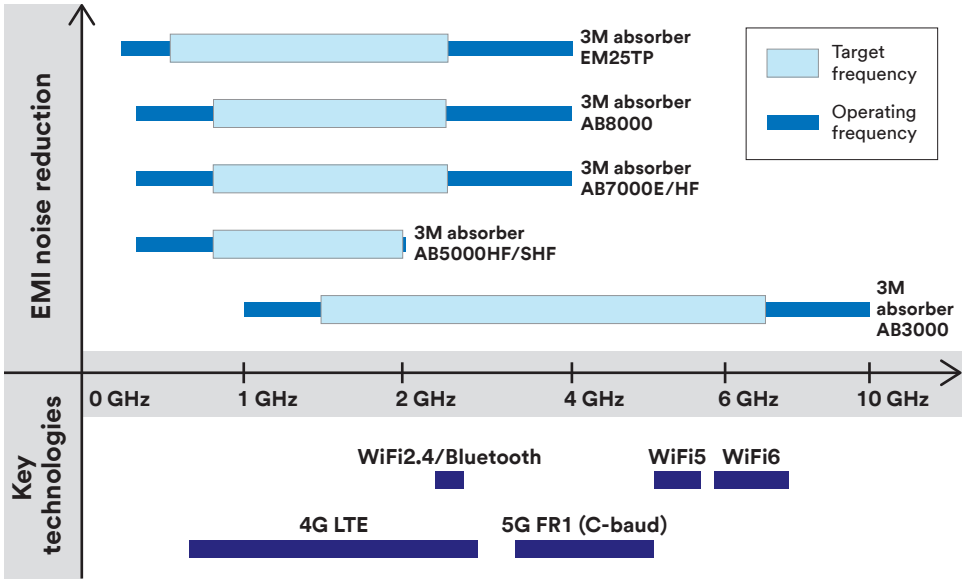
Select absorber series offer with and without adhesive. Check the Technical Data Sheet to learn more

3M Hybrid Shielding Absorber

AB6005HF (AL+PET),
AB6005SHF (PET+AL+PET)
Shielding frequency - 10MHz – 18GHz



EMI absorbing performance



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*Halogen free is defined as having maximum 900 ppm bromine, maximum 900 ppm chlorine, and maximum 1500 ppm total bromine and chlorine, per IEC 61249-2-21.

3M™ EMI Absorbers

3M product number	Thickness mil (mm)	Adhesive	Initial permeability @1MHz or 3MHz [μ']	Operating frequency MHz-GHz	Operating temp range (°C)	Unique features and benefits
EM25TP-005-A10 EM25TP-0100-A10 EM25TP-0200-A20	2 (0.05), 4 (0.1), 8 (0.2)	Non-conductive acrylic (optional)	250	200MHz – 4GHz	-25 ~ 90°C	» Broad frequency absorber » High permeability magnetic film » Absorbing performance 200GHz – 4GHz » Targeted permeability for magnetic shielding <100 kHz – 3 MHz
AB7010HF AB7020HF AB7030HF AB7050HF	5.2 (0.13), 9.8 (0.25), 14 (0.35), 22 (0.55)	Acrylic non-conductive PSA	110	300MHz – 4GHz	-25 ~ 85°C	» Good workability » High resistivity » High permeability » Improved lower frequency absorber vs the 3M Absorber AB5000 series (@ <1GHz)
AB5010HF/SHF AB5020HF/SHF AB5030HF/SHF AB5050HF/SHF AB5100HF/SHF	4 (0.1), 8 (0.2), 12 (0.3), 19.5 (0.5) 39 (1.0)		55 HF, 30 SHF	300MHz – 2GHz	-25 ~ 85°C	» AB5000HF: Standard absorber » AB5000SHF: Advanced EMI absorber, lower peak absorber frequency than 3M EMI Absorber AB5000HF, thermal conductivity 0.7 W/m-K
AB6005SHF AB60005HF	4 (0.1)		30 – 250	10MHz – 18GHz	-30 ~ +105°C	» Excellent for EMI shielding & insulation » Aluminum layer provides excellent shielding effectiveness up to 18 GHz » Available in sheets or rolls » PET absorber reduces EMI and ESD in enclosed cavities
AB7010E/AB7010E-WO AB7020E/AB7020E-WO AB7030E/AB7030E-WO AB7050E/AB7050E-WO	4 (0.1), 8 (0.2), 12 (0.3), 19.5 (0.5)	Non-conductive acrylic (optional)	100u' @ 3 MHz	300MHz – 4GHz	-25°C – 105°C	» High permeability » Available with and without (-WO) adhesive » Long shelf life (18 months) » Broader temperature performance than 3M absorber AB7000HF series
AB8010-WO AB8020-WO AB8030-WO AB8050-WO	4 (0.1), 8 (0.2), 12 (0.3), 19.5 (0.5)	No adhesive	110u'~130 @ 3 MHz	300MHz – 4GHz	-40°C – 150°C	» High permeability » High performance resin system for solder reflow stable performance » High temperature resistance (150°C) » Available without adhesive (-WO) » Long shelf life (2 years)
AB3010/AB3010-WO AB3030/AB3030-WO AB3050/AB3050-WO	4 (0.1), 12 (0.3), 19.5 (0.5)	Non-conductive acrylic (optional)	30	1GHz – 10GHz	-25°C – 90°C	» Broad absorbing performance1-10 GHz » Availability with and without (-WO) adhesive » Large sheet format for improved yield (340mm x 340mm)

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3M™ Magnetic Shielding Materials

3M™ Magnetic Shielding Materials are thin, lightweight, magnetic materials that interact and influence electromagnetic (EM) fields. More effective than copper or aluminum tapes at low frequencies, these materials help protect sensitive electronic components and circuitry by shielding external low-frequency magnetic fields (<1MHz). Their very high magnetic permeability and low magnetic loss help protect against strong magnetic fields and help enable flux field redirection for applications less than 20MHz.

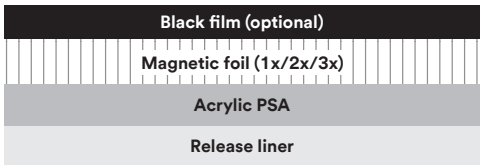
Features and benefits

- High permeability magnetic foil
- Low resistivity options
- Good workability
- Approximately 80,000 permeability dependent on product and thickness
- Thin overall construction
- Optional pressure sensitive acrylic tape for high adhesion
- Supplied on a removable liner for easy removal
- Customization available

Product construction

3M Single Layer Metal Alloy Foil

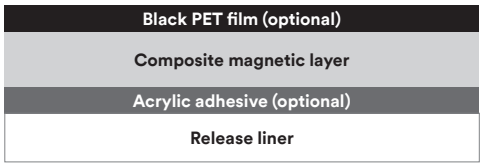
EM80KM



3M Composite Magnetic Foil

EM25TP Series

AB3000 Series



(3M absorber AB3000 does not include a black PET film)

Product Usage

- Avionic system shielding
- Analog component shielding
- NFC Antenna shielding
- Inertial measurement units (IMUs) sensor shielding

Applications

Enhanced wireless power charging

Improved near field communication (NFC) antenna range

Improved radio frequency identification (RFID) antenna range

3M product number	Total thickness mil (mm)	Magnetic type (magnetic foil layer type)	Adhesive type	Permeability (u')	Operating temp range (°C)	Unique features and benefits
3M™ Flux Field Directional Material EM80KM	2 (0.05)	Soft magnetic foil, nanocrystalline	Acrylic PSA	Max 80,000	-25 ~ 110°C	» Low frequency focused for magnetic field » High permeability magnetic foil » Thin overall product construction allows for thinner design
EM25TP-005-A10 EM25TP-100-A10 EM25TP-0200-A20	2 (0.05), 4 (0.1), 8 (0.2)	Soft magnetic composite	Acrylic PSA	250	–	» Broad frequency absorber » High permeability magnetic film » Absorbing performance 100MHz - 4GHz » Targeted permeability for magnetic shielding <5MHz - 10MHz
AB3010/AB3010-WO AB3030/AB3030-WO AB3050/AB3050-WO	4 (0.1), 12 (0.3), 19.5 (0.5)	–	Non-conductive acrylic (optional)	30	-25°C – 90°C	» Broad absorbing performance 1-10 GHz » Availability with and without (-WO) adhesive » Large sheet format for improved yield (340mm x 340mm)

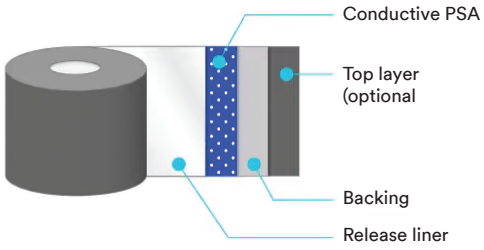
The above technical information and data should be considered representative or typical only and should not be used for specification purposes. Contact your 3M Technical Representative for details.

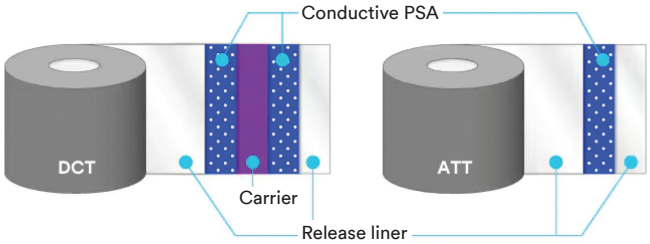
3M™ Electrically Conductive Tapes Selection Criteria

Choosing 3M™ Electrically Conductive Tapes for grounding, shielding, and attachment helps enable equipment to meet basic application requirements for tapes, backings/carriers, fillers and adhesives. You can choose solutions for such specific factors as R target, contact surface type, adhesion level, bond line thickness, XYZ or Z conductivity path, operating temperature range and environmental conditions.

Tape types

Whether you need a single-sided tape to cover a shield-can, a double-coated tape to ground an FPC or an adhesive transfer tape for laminating to a film for a custom stackup in sensor grounding, 3M has all three tape types for your unique designs – single-sided, double-coated, and adhesive transfer tapes.





Single-sided tapes - EMI shielding, covering, and grounding

These electrically conductive tapes deliver XYZ-axis conductivity, based on conductive adhesive type and conductive backing type. Some tapes offer an optional top layer to provide additional features such as color, anticorrosion, conductivity and insulating properties.

Double-sided tapes – grounding and shielding in the bond line gap

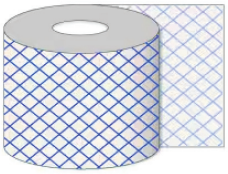
3M™ Double-sided Electrically Conductive Tapes include:

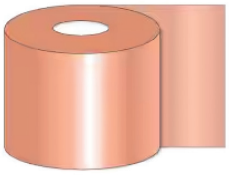
Double-coated tapes (DCTs) DCTs have a carrier with adhesive coated to both sides. These tapes are highly conductive through the adhesive thickness (Z-axis) and the adhesive plane (XY-Axis). Application can be similar to adhesive transfer tapes (ATT), but DCTs are easier to handle and die-cut.

Adhesive transfer tapes (ATTs) ATTs deliver high conductivity through the adhesive thickness (Z-axis). The adhesive is coated directly to a release liner on both sides, making it ultra-conformable. ATTs are often laminated to films and other materials for custom stackups.

Tape backings/carriers

3M™ Electrically Conductive Single-Sided Tapes feature backings and 3M™ Electrically Conductive Double-Sided Tapes feature carriers that provide stability and conformability as well as variable stretchability and shielding effectiveness.





Conductive fabric tapes

Many of our tapes include a fabric carrier or backing with conductive particles designed into them. Easy-handling conductive fabric tapes are very flexible and conformable, including around some corners, and offer increased tear resistance.

Fillers

3M™ Electrically Conductive Adhesive Tapes combine 3M expertise in conductive particle matrices for extremely high grounding and shielding performance. Our variety of conductive fillers including Ni, Cu, silver, graphite and others are available for a wide range of electrical performance.

Foil tapes

Backed by metal foils including copper, these tapes deliver added EMI shielding effectiveness and can be very conformable based on foil layer and adhesive layer thickness.

Adhesives

Our range of electrically conductive adhesives allows you to specify for multiple levels of adhesion to a variety of substrates and surfaces. Particle matrices within the adhesives can deliver conductive performance for contact R, XYZ/Z-axis conductivity and more. Our latest electrically conductive adhesives include our polyolefin conductive pressure sensitive adhesive (CPSA).

3M™ Electrically Conductive Tapes Selection Criteria (continued)

The "□**Good**-□**Better**-■**Best**" rankings are based on 3M test methods and tape performance in a nominal application.

**This information is based on tests performed at 3M laboratory facilities. While we believe that these test results are reliable, your results may vary due to differences in test conditions, your facility/lab environment, or the other conditions within your control. This information is intended for industrial/occupational use by persons with the knowledge and technical skills to analyze, handle and use such information. It is supplemental only and is not intended to replace the detailed information found in written 3M product specific date sheets. For additional information, including important safety and warranty information, regarding 3M products, please refer to the data sheets, instructions and/or installation manuals.*

Product	Typical contact resistance (R ohms Ω)	EMI shielding in bond line gap/slit	Flex to PCB contact resistance (R ohms Ω)	Peel strength (24 hr/RT)	Workability	Thermal conductivity/resistance (W/mK or C/W)
3M™ Electrically Conductive Double-Sided Tapes						
3M™ Electrically Conductive Adhesive Transfer Tapes						
3M tape 9703	Good	N/A	Better	Good	Good	Good
3M tape 9712	Good	Good	Good	Better	Good	Good
3M tape 9713	Better	Good	Good	Better	Good	Good
3M™ Electrically Conductive Double-Coated Tapes						
3M tape 9772	Best	Best	Good	Good	Best	Best
3M tape 9711S	Best	Better	Best	Best	Best	Better
3M™ Electrically Conductive Single-Sided Tapes						
3M tape 3304BC-S	Best	Best	Best	Better	Better	Good
3M tape 1020BC	Best	Better	Best	Good	Best	Better
3M tape 1050TC	Best	Better	Best	Good	Better	Best

- **Typical contact resistance** - Gold flex bonded to stainless steel (SS). "Best" results relate to a lower contact R potential on SS Contact R can vary with SS type tested. Lower contact resistance can allow for improved EMI shielding of a design.
- **EMI Shielding in Bond Line "Gap/Slit"** - Best = High dB EMI Shielding. Inherent EMI shielding at the bond line provides significantly reduced crosstalk, stray EMI, noise in circuit, antennae effects, FPC susceptibility and spurious emissions.
- **Flex to PCB Contact Resistance** - Potential to improve contact R grounding locations via improved surface conformability and XYZ conductive potential with a 3M electrically conductive tape or film vs. a generic Z-axis only conductive PSA.
- **Peel Strength** - Adhesion to SS type substrate/3M Test Method/24 hour room temp dwell.
- **Workability** - Ease of Rework based on a standard set of high surface energy substrates. The tape design can affect rework based on adhesive type and conductive filler type.
- **Thermal Conductivity/Thermal Resistance** - Effective Thermal Resistance and Thermal Conductivity vs. a generic PSA without conductive fillers. Important for thermal connection performance between substrates.

3M™ Electrically Conductive Single-Sided Tapes

3M™ Electrically Conductive Single-Sided Tapes deliver XYZ-axis conductivity in a variety of conductive adhesives, carriers, and fillers to provide EMI/RFI shielding and/or grounding across multiple frequencies for critical systems. Copper foil tapes provide maximum shielding effectiveness and metalized fabric tapes offer improved conformability. These tapes are available in multiple thicknesses and the flexibility, conformability, strong adhesion, and temperature resistance needed for critical applications.

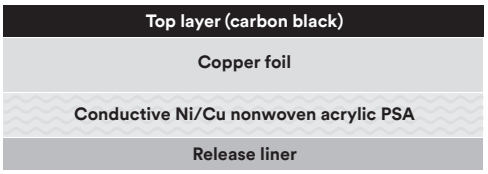
Features and benefits

- XYZ-axis conductivity
- Conformability and edge conformance
- Excellent EMI/ESD and electrical performance over time
- Reliable electrical contact in small areas and bond lines
- High adhesion for reliable contact to various substrates
- Great handling & workability
- Thin and lightweight for applications with less Z-space

Product construction

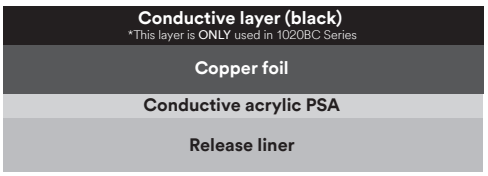
3M Foil Tapes, PSA with conductive nonwoven

3304BC-S



3M Foil Tapes, PSA with conductive fillers

1050TC Series,
1020BC Series*



Product Usage

- Electronic enclosure shielding
- Avionic shielding display wrap
- Antenna base shielding
- Proximity sensor shielding

Applications

Shield can lid | Shielding display wrap | PIM management | Sensor grounding | Display chip on flex

3M product number	Thickness mil (mm)	Conductive filler type and tape format	Adhesive type	Liner type	Electrical resistance through Z-axis Ω (3M ETM-12)	Electrical resistance through XY-axis Ω (3M ETM-7)	Adhesion to SUS (gf/inch)	Unique features and benefits
3304BC-S	1.8 (0.45)	Ni/Cu nonwoven foil backing	Acrylic	Silicone coated PET film	0.05 Ω	0.1 Ω	1300 (ASTM D1000)	» Scratch-resistant black copper foil » Excellent edge conformability » High shielding performances
1050TC	0.9 (0.023)	Foil backing C-SCT		PET release liner	N/A	0.015 Ω	1200 (ASTM D1000)	» XYZ-conductivity » Conformable, quick bonding » Copper foil backing
1020BC	1.0 (0.025)	Foil backing C-SCT				0.015 Ω	1300 (ASTM D1000)	» XYZ-conductivity » Excellent EMI shielding performance » Excellent conformability and quick bonding » Reliable contacts to small size grounding areas » High adhesion and good grounding performance to many surface types » Black conductive coating

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Contact your 3M Technical Representative for details.

3M™ Electrically Conductive Double-Coated Tapes

3M™ Electrically Conductive Double-Coated Tapes feature XYZ-axis conductivity and a carrier coated with adhesive on both sides. Easier to handle and die-cut than adhesive transfer tapes without a carrier, these tapes provide enhanced EMI performance where and when you need it, with flexibility, conformability, high adhesion, and excellent temperature resistance. Choose copper foil tapes for maximum shielding effectiveness over a broad frequency range, and metalized fabric tapes for better conformability to irregular surfaces.

Features and benefits

- XYZ-axis conductivity
- A broad range of thicknesses
- Electrical contact to small contact areas and bond lines
- Excellent grounding performance over time
- Great EMI shielding in bond line gap
- Multiple levels of adhesion, conformability, and flexibility
- Adhesion to a variety of substrates and surfaces
- Great handling & workability

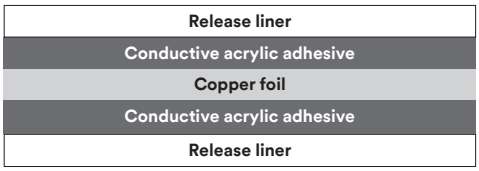
Product construction

3M Woven Fabric Tapes

9711S Series

3M High Performing Foil Tapes

9772 Series



Product Usage

- Avionic enclosure seam shielding
- Avionic display grounding
- Antenna grounding
- Communication system grounding
- Low outgassing satellite component grounding

Applications

Flex circuit to flex circuit interconnection | Sensor grounding | Electrostatic discharge (ESD) | EMI shield and gasket attachment | PCB/flex/ chassis grounding | FPC grounding

3M product number	Thickness mil (mm)	Conductive filler type and tape format	Adhesive type	Liner type	Electrical resistance through Z-axis Ω (3M ETM-12)	Electrical resistance through XY-axis Ω (3M ETM-7)	Adhesion to SUS (gf/inch)	Unique features and benefits
9772	1.2 (0.03), 2 (0.05)	Foil backing	Acrylic	PET release liner	N/A	0.015 Ω	1000 (ASTM D1000)	» Good EMI shielding in the bondline gap » Best XY-axis electrical resistance in double-sided conductive PSAs » Low PIM
9711S	2 (0.05)	Ni/Cu woven			0.05 Ω	0.15 Ω	1800 (ASTM D1000)	» Low contact resistance » High adhesion » Excellent conformability » Quick bonding » Wide range of thickness options

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3M™ Electrically Conductive Adhesive Transfer Tapes

3M™ Electrically Conductive Adhesive Transfer Tapes deliver a broad spectrum of performance, including high EMI shielding in the bond line gap for high-frequency attenuation, stable contact resistance for reliable electrical conductivity, and ultra-comfortability for reliable contact to various substrates. The Z-axis conductive tapes are ideal for flex-PCB bonding, virtually eliminating the need for a mechanical connector. Multiple thicknesses, conductive fillers, particle designs, and low-outgassing (ASTM E595 Class A) options are available.

Features and benefits

- XYZ-axis conductivity or Z-axis based conductivity
- A broad range of thicknesses
- Electrical contact to small contact areas and bond lines
- Excellent grounding performance over time
- Great EMI shielding in bond line gap
- Multiple levels of adhesion, conformability, and flexibility
- Adhesion to a variety of substrates and surfaces
- Great handling & workability
- Longer shelf life options

Product construction

3M Conductive Tapes with silver filler

9703	Release liner Filled conductive acrylic PSA Release liner

3M Conductive Tapes with conductive fibers

9712, 9713	Conductive adhesive Conductive nonwoven Conductive adhesive Release liner

Product Usage

- Avionic enclosure seam shielding
- Avionic display grounding
- Antenna grounding
- Communication system grounding
- Low outgassing component grounding

Applications


Flex circuit to flex circuit interconnection


Camera module grounding


Electrostatic discharge (ESD)


EMI shield and gasket attachment


PCB/flex/ chassis grounding


FPC grounding


Sensor grounding


Bond line gap shielding

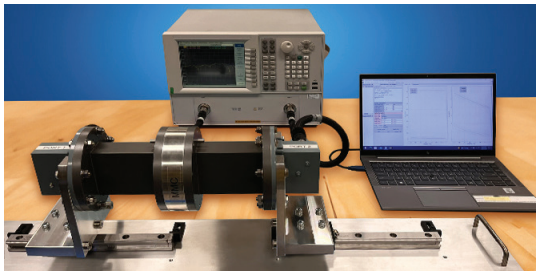
3M product number	Thickness mil (mm)	Conductive filler type	Adhesive type	Liner type	Electrical resistance through Z-axis Ω (3M ETM-12)	Electrical resistance through XY-axis Ω (3M ETM-7)	Adhesion to SUS (gf/inch)	Unique features and benefits
9703	2 (0.05)	Silver particles	Acrylic	Silicone treated PCK	0.01 Ω	N/A	907 (ASTM D1000)	» Anisotropic Z-axis electrical conductivity » Low outgassing » Pressure-sensitive adhesive (PSA) tack properties » Thermal curing not required
9712	5 (0.127)	Carbon nonwoven		Silicone treated PCK	13 Ω	50-70 Ω	1500 (ASTM D3330)	» Standard adhesion » No nickel » Non-magnetic material » Nonwoven conductive scrim
9713	3.5 (0.089)	Ni/Cu nonwoven			1.7 Ω	5 Ω		» Standard adhesion » Isotropic XYZ-axis electrical connectivity » Uses nickel plated carbon scrim » Good contact with both hard and soft surfaces » Excellent die-cutting and converting capabilities

The above technical information and data should be considered representative or typical only and should not be used for specification purposes.
Contact your 3M Technical Representative for details.

Tested Reliable Solutions

We know you need high-quality products. 3M solutions deliver material properties to help you solve your application requirements. 3M has extensive testing capabilities which include:

- Simulation and modeling
- Shielding effectiveness measurement
- Permeability and permittivity measurements
- Reliability testing for age, humidity and temperature cycling
- And more



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