



# XYZ/Isotropic Electrically Conductive Adhesive Transfer Tape

## 9708 • 9709

Technical Data

January, 2007

### Product Description

3M™ XYZ/Isotropic Electrically Conductive Adhesive Transfer Tape 9708 and 9709 are pressure sensitive adhesive (PSA) transfer tapes with Isotropic electrical conductivity. The PSA matrix is filled with conductive fillers which allow interconnection between substrates through the adhesive thickness (the “Z-axis”) and also provides electrically conducting in the plane of the adhesive (“X-Y Axis”). The PSA tack and adhesion properties allow for room temperature application and assembly processes.

3M tape 9708 and 9709 are excellent choices for EMI shield attachment and grounding applications. 3M tape 9708 and 9709 offers good adhesion to common substrates such as copper, aluminum, gold, stainless steel, FR-4 epoxy, Kapton™ polyimide and polyester films.

3M tape 9708 and 9709 provides an electrical connection and adhesively bonds EMI/RFI shields and gaskets to metal frames and enclosures. The low contact resistance and tape construction result in good EMI performance. 3M tape 9708 and 9709 can be applied as die cut parts or in roll form.

3M tape 9708 in comparison to 3M tape 9709 offers the best XYZ electrical conductivity performance with good adhesion. Comparatively 3M tape 9709 offers improved adhesion with good XYZ electrical conductivity performance. As each application is unique, offering two options to test in 3M tape 9708 and 9709 allows customers to evaluate which will work best given their product design. In many designs, 3M tape 9708 and 9709 will perform equivalently.

As in all conductive PSA applications, stable electrical performance in any electrical connection application may require added mechanical reinforcement (clamping or compressing) in the bond area.

| Construction | Property              | Value  |
|--------------|-----------------------|--|
|              | Adhesive Type         | Filled Acrylic Pressure Sensitive                      |
|              | Release Liner         | Silicone-treated Polyester liners (Dual Lined Product) |
|              | Approximate Thickness |  |
|              | Adhesive              | 2 mil (50 μm)  |
|              | Liner(s)              | 2 mil (50 μm) / 1.5 mil (37.5 μm)                      |

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## Typical Physical Properties and Performance Characteristics Adhesive Properties: Peel Adhesion to Substrates & Noted Dwell Times

*Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.*

| Peel Test  | 3M™ XYZ/Isotropic Electrically Conductive Adhesive Transfer Tape   |                       |
|--|--|-----------------------|
|  | 9708   | 9709                  |
| Peel Adhesion to SS  | 50 oz/in @ 96 hrs RT   | 55 oz/in @ 96 hrs RT  |
| Peel Adhesion to Polyimide   | 40 oz/in @ 125 hrs RT*   | 42 oz/in @ 125 hrs RT |
| Peel Adhesion to Gold Plated Copper  | 39 oz/in @ 125 hrs RT*   | 41 oz/in @ 125 hrs RT |
| Modified ASTM D3330 180-degree peel test, 12in/min, 2mil PET film backing used for peel testing.<br>*estimated |  |                       |
| Outgassing (Dynamic Headspace Analysis)  | 85°C, for 3 hrs, high purity nitrogen<br>Total out-gassing (wt% estimate)  | estimate<br><2.0%     |
| Temperature Performance <sup>1</sup>   | Application Use Temperatures: -40 to 85°C<br>Varies with application design. See note 1.<br>See also the Application section of this document  |                       |
| Shelf Life and Storage Conditions  | Tape in roll form: Shelf life 24 months from the date of manufacture when stored in original cartons at 21°C (70°F) and 50% relative humidity. |                       |

## Electrical Properties:

| Test Method  | 3M tape 9708                       | 3M tape 9709                       |
|--|------------------------------------|------------------------------------|
| Current Carrying Capacity  | Estimated 1.0 Amps/in <sup>3</sup> | Estimated 1.0 Amps/in <sup>3</sup> |
| Z-Axis Resistance @ 1 Hr Dwell, 2mm x 5mm contact area <sup>1,2,4</sup>  | 0.13 ohms                          | 0.17 ohms                          |
| XYZ-Axis Resistance @ 1 Hr Dwell, Spanning a set of several 0.5mm Pitch & 0.5mm line width traces 5mm wide test strip // 10mm wide test strip <sup>1,2,4</sup> | 0.08 ohms // 0.06 ohms             | 0.08 ohms // 0.08 ohms             |
| XYZ-Axis Resistance @ 1 Hr Dwell, Spanning two 2.0mm wide traces separated by 2mm Pitch 5mm wide test strip // 10mm wide test strip <sup>1,2,4</sup>           | 0.52 ohms // 0.24 ohms             | 0.98 ohms // 0.59 ohms             |

## Thermal Performance

|                               |                |
|-------------------------------|----------------|
| Apparent Thermal Conductivity | 0.6 - 0.7 W/mk |
|-------------------------------|----------------|

1. Application Use Temperature range of the 3M tape 9708 and 9709 may be increased or have improved reliability with the use of a mechanical clamping system as determined by the end use customer. The temperature use range is dictated by two primary items: Temperature performance of the acrylic adhesive (generally -40 to 95°C depending on other environmental conditions) and the potential movement of the conductive fillers in the adhesive system. The primary items leading to best performance of the 3M tape 9708 and 9709 for resistance performance include, but are not limited to: assembled bond line force, types of substrates bonded, flexible substrate to flexible bond or flexible to rigid bond, surface features in bonded area, etc. (See page 3 for more information on mechanical clamping.)
2. Two wire resistance measurement (4-wire test would be lower), 5mm or 10mm wide strip of 3M tape 9708 and 9709 laminated to a polyimide film. The 3M tape 9708 or 9709/Polyimide film laminate is then laminated to a rigid PCB with gold plated copper traces. The 0.5mm span XYZ test uses the 5mm or 10mm wide strip to span several gold plated copper traces that are 0.5mm wide and spaced 0.5mm apart to evaluate the ability of the 3M tape 9708 or 9709 to span a series of conductive side by side traces that connect to a common test pad. The XYZ test spanning the 2.0 mm gap only tests from one 2mm wide trace to an adjacent 2mm wide trace. The Z-axis test uses the 3M tape 9708 and 9709 laminated to a gold plated PET that is then laminated to the 2mm wide PCB trace and a gold plated copper test pad to allow Z-Axis performance testing.
3. Estimated, customers are required to qualify the maximum current capability for their application.
4. Minimum recommended conductor overlap area (pad area) in the interconnection of individual circuit lines to ensure Z-Axis conduction must be optimized for each application and environmental and mechanical design conditions.

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## Alternating Current (A/C) Non-Contact X-Y Conductivity Test

A sample of material is placed into the A/C test system. Current is applied and resistance is measured for X-Y conductivity of the test film itself. Results are “1/ohms”. Lower number is indicative of inherent A/C resistance to current flow through the plane of the adhesive (not Z-axis).

| Sample   | A/C Test Results ( 1/ohms) |
|--|----------------------------|
| 3M™ Electrically Conductive Adhesive Transfer Tape |                            |
| 9705   | > 100 ( Z-axis PSA)        |
| 9713   | 7.63                       |
| 9709   | 1.24                       |
| 9708   | 0.41                       |

## ASTM D-4935 Modified Shielding Effectiveness of Planar Materials

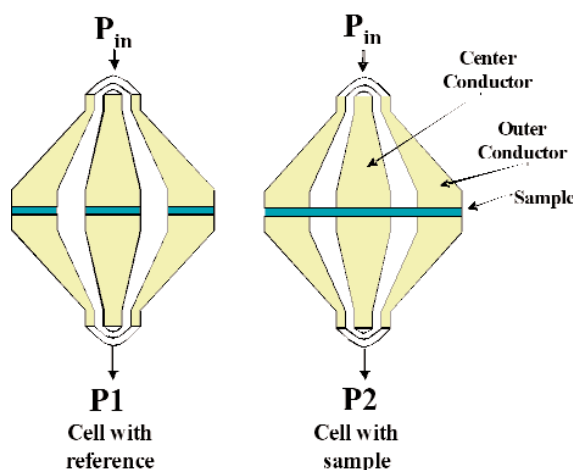
The test method covers the EMI source path (P<sub>in</sub>) with a planar test material. The planar material can inhibit the EM wave and a reduced signal is measured at P<sub>2</sub>.

The effectiveness of the planar material is based on the backing material and the adhesive, plus the overlap of the planar material over the gap.

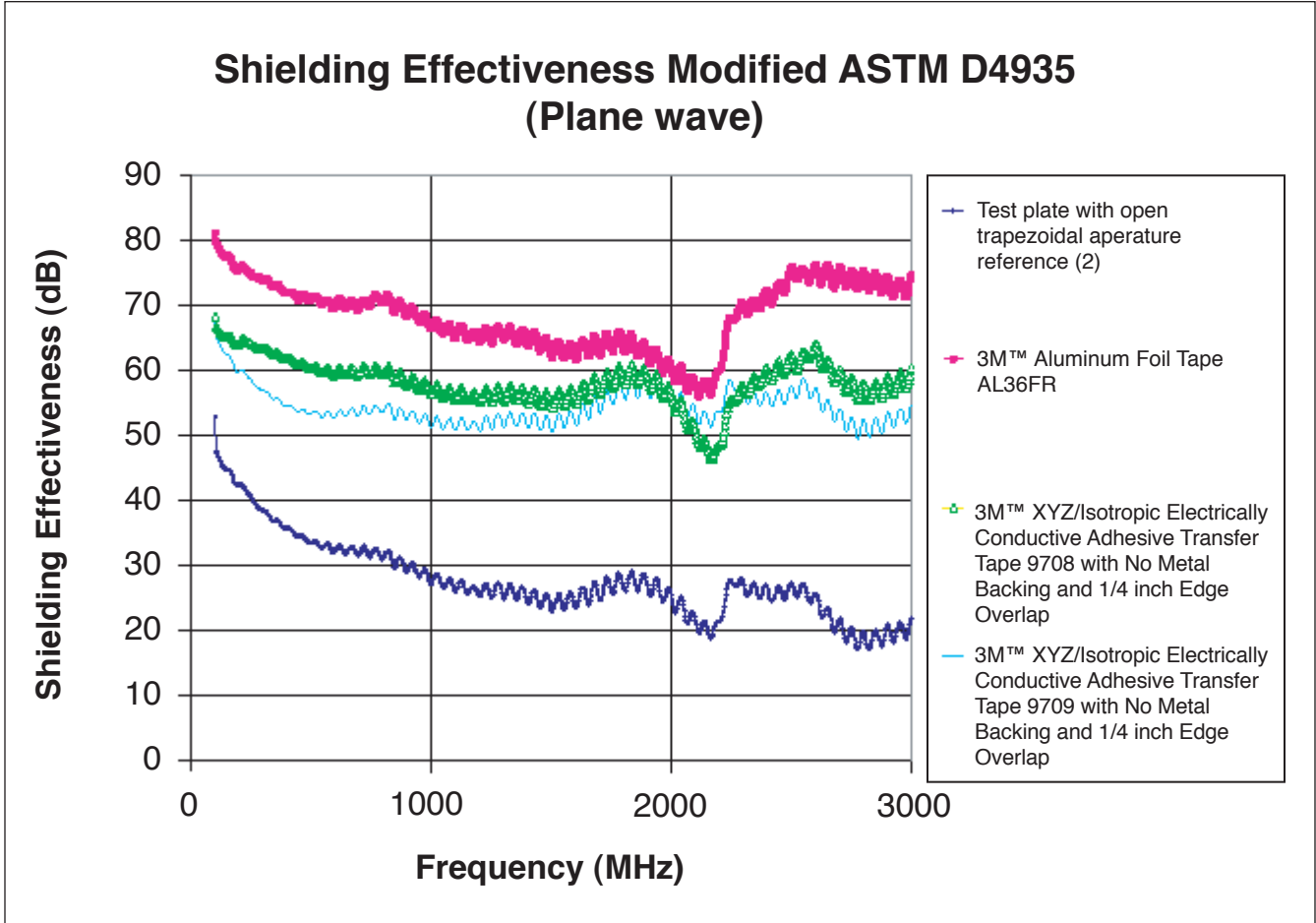
### ASTM D4935 SE test Set-up

#### Shielding Effectiveness (dB)

Method DASTM-D-4935



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| Available Sizes | Slit Tape Width                       | Standard Length     | Maximum Length        |
|-----------------|---------------------------------------|---------------------|-----------------------|
|                 | 0.25 to 0.5 inch<br>(6.9 mm to 13 mm) | 36 yds.<br>(32.9 m) | 36 yds.<br>(32.9 m)   |
|                 | 0.5 to 12 inch<br>(13 mm to 304 mm)   | 36 yds.<br>(32.9 m) | 108 yds.<br>(98.8 m)  |
|                 | Normal Slitting Tolerance:            |                     | 0.065 in.<br>(0.8 mm) |

## Application Techniques

### Bonding

- To obtain maximum adhesion, the bonding surfaces must be clean and dry.
- Pressure must be applied to the bond line after assembly to wet the substrates with 3M™ XYZ/Isotropic Electrically Conductive Adhesive Transfer Tape 9708/9709 and to engage the conductive filler with the substrates to make electrical connection. Mechanical pressure (roller, metal bar) or finger pressure at 15 psi (0.10 Mpa) or greater is suggested. Heat may be applied simultaneously to improve wetting and final bond strength.
- 3M tape 9708/9709 should be applied between 60°F - 158°F (15°C - 70°C). Tape application below 50°F (10°C) is not recommended because the adhesive will be too firm to wet the surface of the substrate, resulting in low adhesion.
- Adhesion builds with time, up to 24 -72 hours may be required to reach final adhesion values.

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## Application Techniques (continued)

### Mechanical Clamping

To assure electrical resistance stability of 3M™ XYZ/Isotropic Electrically Conductive Adhesive Transfer Tape 9708/9709 in an application, a mechanical clamp or other compressive force (i.e. foam strip held in compression over bond area, clamping or pressure inherent in the design assembly.) should be considered in the design of the application. Any stress inherent in the assembly design (i.e. tensile, shear, cleavage) or temperature excursions or cycling (encountered through normal product use) applied to the bond area could result in an electrical open or higher resistance in the bonded area when no clamp or mechanism for maintaining a constant compressive force is used. A well designed mechanical clamp will reduce the environmental stress on the bond line and improve the electrical reliability of the bond. In addition, the temperature operating range for the adhesive can be improved with a properly designed mechanical clamping system to ensure the conducting fillers in the 3M tape 9708/9709 maintain electrical contact. Several types of mechanical clamps are options to consider, such as foam strips attached to lids or cases and screw-attached plastic clamps. Contact your 3M Technical Service Engineer for further information about mechanical clamping.

### Temperature Performance

The electrical performance of 3M tape 9708/9709 is more sensitive to temperature or cycling than the peel performance. Coefficient of Thermal Expansion (CTE) mismatch and thermal cycling in the contact substrates and adhesive can lead to fillers moving and an increase in resistance can occur. The user is responsible for the temperature performance qualification of 3M tape 9708/9709 in their design.

### Rework

Mechanically separate the parts using torque (for rigid parts) or peel (for flexible parts). Remove the adhesive by rubbing it off with a 3M™ Scotch-Brite™ Pad, clean up the site, and apply new adhesive. The force needed to separate the parts and/or remove the adhesive can be reduced by softening the adhesive by heating 158°F -212°F (70°C - 100°C) or using solvents.\*

***\*Note: When using solvents, be sure to follow the manufacturer's precautions and directions for use when handling such materials.***

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## General Information

3M tape 9708/9709 is part of a family of conductive tapes. For applications where mechanical clamping is not desired, or where improved electrical, thermal, and mechanical performance is required, these alternative products should be considered.

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## Conductive PSA Adhesive Product Selection Guide

| 3M™ Electrically Conductive Adhesive Transfer Tape | EMI Shield/Cage |      |       | Gasket Attachment / Grounding | Attributes |          |           |
|--|-----------------|------|-------|-------------------------------|------------|----------|-----------|
|  | SS              | Alum | Cloth |                               | PSA Type   | Filler   | Thickness |
| 9712   |                 | x    | x     | x                             | Acrylic    | Scrim    | 5.0 mil   |
| 9713   | x               | x    | x     | x                             | Acrylic    | Scrim    | 3.0 mil   |
| 9719   | x               | x    | x     | x                             | Silicone   | Scrim    | 4.0 mil   |
| 9708 / 9709  | x               | x    | x     | x                             | Acrylic    | Particle | 2.0 mil   |
| 9705   | x               | x    | x     | x                             | Acrylic    | Particle | 2.0 mil   |

### Application Ideas

3M™ XYZ/Isotropic Electrically Conductive Adhesive Transfer Tape 9708/9709 is ideal for EMI/RFI shield and gasket attachment applications, grounding application and larger Z-axis connections where the 3M tape 9708/9709 is die cut for each Z-axis connection. Applications include EMI shields for displays and gasket attachment to EMI/RFI cabinets and enclosures.

### For Additional Information

To request additional product information or to arrange for sales assistance, call toll free 1-800-251-8634. Address correspondence to: 3M Electronics Markets Materials Division, Building 21-1W-10, 900 Bush Avenue, St. Paul, MN 55144-1000. Our fax number is 651-778-4244 or 1-877-369-2923. In Canada, phone: 1-800-364-3577. In Puerto Rico, phone: 1-787-750-3000. In Mexico, phone: 52-70-04-00.

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