



# Electrically Conductive Adhesive Transfer Tape

## 9703

Technical Data

April, 2006

### Product Description

3M™ Electrically Conductive Adhesive Transfer Tape 9703 is a pressure sensitive adhesive (PSA) transfer tape with anisotropic electrical conductivity. The PSA matrix is filled with conductive particles which allow interconnection between substrates through the adhesive thickness (the “Z-axis”) but are spaced far enough apart for the product to be electrically insulating in the plane of the adhesive. The PSA tack properties and lack of any thermal curing make tape 9703 easy to use in assembly operations.

Tape 9703 electrically connects and mechanically bonds medium pitch flexible circuits with other flexible circuits (flex), rigid printed circuit boards (PCB) or LCD screens. Electrically conductive tape 9703 offers good adhesion to common PCB substrates such as copper, gold, FR-4 epoxy, Kapton™ polyimide and polyester films. Stable electrical performance in any flexible circuit interconnection application may require mechanical reinforcement (clamping).

Tape 9703 also electrically connects and mechanically bonds EMI/RFI shield and gaskets to metal frames and enclosures. The low contact resistance and tape construction result in good EMI performance. Tape 9703 can be applied as die cut parts or in roll form and has good adhesion to common EMI/RFI substrates such as aluminum, stainless steel, and smooth gasket materials.

### Construction

| Property              | Value                                   |
|-----------------------|-----------------------------------------|
| Adhesive Type         | Filled Acrylic Pressure Sensitive       |
| Release Liner         | Silicone-treated Polycoated Kraft paper |
| Approximate Thickness |                                         |
| Adhesive              | 2 mil (50 µm)                           |
| Liner                 | 4 mil (100 µm)                          |

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## Typical Physical Properties and Performance Characteristics

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

### Adhesive Properties:

Peel Adhesion to Stainless Steel

| Dwell Time | Temperature              |                        |
|------------|--------------------------|------------------------|
|            | 23°C (72°F)              | 70°C (158°F)           |
| 15 min     | > 35 oz./in. (3.82 N/cm) | 50 oz./in. (5.45 N/cm) |
| 1 hour     | 50 oz./in. (5.45 N/cm)   | 60 oz./in. (6.54 N/cm) |
| 24 hour    | 55 oz./in. (6.00 N/cm)   | 65 oz./in. (7.08 N/cm) |

(ASTM D3330), 2 mil Aluminum foil used as backing

Outgassing:

(NASA SP-R-0022  
or ASTM E595)

125°C, 24 hrs, 2 x 10<sup>-6</sup> Torr vacuum

Total Mass Loss (TML)

0.7%

Collected Volatile Condensable Materials (CVCM)

0.01%

Temperature Performance<sup>6</sup>

Application Use Temperatures: -20 to +40°C

Application Storage Temperatures: -30 to +70°C

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:

|                                        |                                              |
|----------------------------------------|----------------------------------------------|
| Insulation Resistance <sup>1</sup>     | 3.4 x 10 <sup>14</sup> Ohms/□                |
| Contact Resistance <sup>2</sup>        | 1.25 milliOhm-in <sup>2</sup>                |
| Contact Resistivity <sup>2</sup>       | 1.6 Ohm-cm                                   |
| Current Carrying Capacity <sup>3</sup> | 1 amp/in <sup>2</sup>                        |
| Minimum Gap <sup>4</sup>               | 15 mil (0.4 mm)                              |
| Minimum Overlap Area <sup>5</sup>      | 5000 mil <sup>2</sup> (3.2 mm <sup>2</sup> ) |

1. Based upon ASTM D-257

2. 4 wire resistance measurement, 2500 mil<sup>2</sup> overlap area, 0.5 Ohm measured resistance between overlapping silver ink traces (50 mil wide) on PET flex circuit. Contact your 3M Technical Service Engineer for more details of this testing.

3. Estimated, customers are required to qualify the maximum current capability for their application.

4. Minimum free space between adjacent conductors recommended to ensure electrical isolation. Customers may qualify finer pitch performance in their applications.

5. Minimum recommended conductor overlap area (pad area) in the interconnection of individual circuit lines to ensure Z-Axis conduction.

6. Application Use Temperature range of the 3M™ Electrically Conductive Adhesive Transfer Tape 9703 may be increased with the use of a mechanical clamping system as determined by the end use customer. The temperature range must not exceed -20 to +70°C. (See page 3 for more information on mechanical clamping.)

## 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 354 mm)  | 36 yds.<br>(32.9 m)     | 108 yds.<br>(98.8 m) |
| Normal Slitting Tolerance:            | 0.03125 in.<br>(0.8 mm) |                      |

\*Contact your 3M Technical Service Engineer for rolls wider than 12 inches.

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## 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™ Electrically Conductive Adhesive Transfer Tape 9703 and to engage the conductive particles 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.
- Tape 9703 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 hours may be required to reach final adhesion values.

### Mechanical Clamping

To assure electrical resistance stability of tape 9703 in any flexible circuit interconnection application, a mechanical clamp or other compressive force (i.e. foam strip held in compression over bond area.) should be considered in the design of the application. Any stress inherent in the assembly design (i.e. tensile, shear, cleavage) or temperature excursions (encountered through normal product use) applied to the bond area could result in an electrical open in the bonded circuit over time when no clamp or mechanism for maintaining a constant compressive forces 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 particles in the tape 9703 maintain electrical contact. Several types of mechanical clamps have been used successfully including 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 tape 9703 is more sensitive to temperature than the peel performance. Tape 9703 is not recommended for high or low temperature excursions where the electrical performance might be compromised, even if holding power is not affected. The user is responsible for the temperature performance qualification of tape 9703 in their design. Contact your 3M Technical Service Engineer for further information about the temperature performance of tape 9703.

### Rework

Mechanically separate the parts using torque for rigid parts and peel for flexible ones. Remove the adhesive by rubbing it off with a 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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9703

## General Information

3M™ Electrically Conductive Adhesive Transfer Tape 9703 is part of a family of anisotropic (Z-Axis) conductive tapes and thermoset films. For applications where mechanical clamping is not desired, or where improved electrical, thermal and mechanical performance is required, these alternative products should be considered.

### Anisotropic Conductive Film Adhesive Product Selection Guide

| Product | Flex Type               |                     |                     | Connection Type |             |              | Pitch    |                     |                          |
|---------|-------------------------|---------------------|---------------------|-----------------|-------------|--------------|----------|---------------------|--------------------------|
|         | Silver Ink on Polyester | Copper on Polyester | Copper on Polyimide | Flex to Glass   | Flex to PCB | Flex to Flex | Moderate | Fine (≥ 100 micron) | Very Fine (≤ 100 micron) |
| 5460R   |                         |                     | x                   |                 | x           | x            |          | x                   |                          |
| 5552R   |                         |                     | x                   | x               |             |              |          |                     | x                        |
| 7303    | x                       | x                   | x                   | x*              | x           | x            | >0.50mm  |                     |                          |
| 7313    | x                       | x                   | x                   |                 | x           | x            | >0.50mm  |                     |                          |
| 9703    | x                       |                     | x                   |                 | x†          | x            | >0.40mm  |                     |                          |
| 9705    | x                       |                     | x                   |                 | x†          | x            | >0.40mm  |                     |                          |

\*Tested only for silver frit traces; not suitable for ITO traces.

†Requires mechanical backup for lowest electrical resistance.

## Application Ideas

Tape 9703 is ideal for interconnection of flexible circuits with other flexible circuits (flex), rigid printed circuit boards (PCB) or LCD screens. Applications include polyester flex circuit splicing, keyboard manufacturing, LCD assembly and many others. Tape 9703 is also ideal for EMI/RFI shield and gasket attachment applications. 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: 1-800-634-3577. In Puerto Rico, phone: 1-787-750-3000. In Mexico, phone: 52-70-04-00.

## Product Use

All statements, technical information and recommendations contained in this document are based upon tests or experience that 3M believes are reliable. However, many factors beyond 3M's control can affect the use and performance of a 3M product in a particular application, including the conditions under which the product is used and the time and environmental conditions in which the product is expected to perform. Since these factors are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for the user's method of application.

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