

# 3M™ Electrically Conductive Adhesive Transfer Tape 9703

## 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
<b>Adhesive Type</b>	Filled Acrylic Pressure Sensitive
<b>Release Liner</b>	Silicone Treated Polycoated Kraft Paper
<b>Approximate Thickness</b>	
<b>Adhesive</b>	2 mil (50 µm)
<b>Liner</b>	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: (Test Method is based on a modified ASTM D3330, 12 ipm peel rate, 1 in. width, 2 mil PET backing, 180 degree)		
Dwell Time @ Room Temperature 23°C	1 Hour 29 oz./in. (3.2 N/cm)	24 Hours 32 oz./in. (3.5 N/cm)
<b>Note:</b> Peel values will often be higher than noted above when using a non-PET backing. Different backing types effect the backing modulus, thickness and stiffness and these differences directly effect the peel test result value. As an example, a 2 mil aluminum backing will change the test value of the peel adhesion as the peel back angle at the interface will change due to the backing stiffness. A 2 mil aluminum backing would generally increase the peel values.		

Temperature Performance <sup>1</sup>	Application Use Temperatures: -40 to +85°C in a properly designed end use application. See Note 1.  Application Storage Temperatures: See "Shelf Life and Storage" comments. End user needs to qualify converted material for a broader storage environmental range.  See also the Application section of this document
Shelf Life and Storage	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.

### 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%

### Electrical Properties:

Insulation Resistance <sup>2,3</sup>	3.4 x 10 <sup>14</sup> ohms/square (estimated based on 3M™ Electrically Conductive Adhesive Transfer Tape 9703)
Contact Resistance <sup>1</sup>	< 0.3 ohms (3M Test Method, Gold PI Flex onto Gold PCB, RT Initial R, 6 mm <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> )

- The final assembly must be tested to verify that the 3M™ Electrically Conductive Adhesive Transfer Tape 9703 can achieve the desired performance in the assembly's end use application environmental conditions (temperature, humidity, temperature cycling, shock, application assembly design, assembly variation, etc.). Tape 9703 may achieve the -40 to +85°C temperature range (or broader temperature range excursions) in an end use application if the final assembly design is designed so that the conductive particles remain in sufficient mechanical contact between surfaces to achieve the desired contact resistance. Some type of mechanical bond line compression design as determined by the end use customer (clip, clamp, screw, compressed foam, etc.) that will apply a constant minimum pressure across the bond line may be required to meet the desired end use environmental ranges and contact resistance specification. The temperature use range is dictated by two primary items: Temperature performance of the acrylic adhesive (generally in the range of -40°C to about 95°C depending on other environmental conditions) as it supports the conductive particles in the adhesive/ particle matrix and the potential movement of the conductive fillers in the adhesive system in an end use application design. Items contributing to the performance of the Tape 9703 for resistance level performance include, but are not limited to: assembled bond line force (constant force present across the bond line after assembly and over the life of the product), types of substrates bonding, surface features in bonded area, environmental conditions, (temperature, humidity, CTE, shock, environmental cycling, etc.), assembly surfaces and Tape 9703 compatibility, Tape 9703 filler and assembly surfaces galvanic potential compatibility, etc. (See section on mechanical clamping for added information).
- Based upon ASTM D-257.
- Estimate based on 3M™ Electrically Conductive Adhesive Transfer Tape 9703 test data.
- Minimum free space between adjacent conductors suggested to ensure electrical isolation. Customers may qualify finer pitch performance in their applications.
- Minimum recommended conductor overlap area (pad area) in the interconnection of individual circuit lines to ensure Z-Axis conduction.

## Available Sizes

Slit Tape Width	Standard Length	Maximum Length
0.25 to 0.5 inch (6.9 to 13 mm)	36 yds. (32.9 m)	36 yds. (32.9 m)
0.5 to 12 inch* (13 to 354 mm)	36 yds. (32.9 m)	108 yds. (98.8 m)
Normal Slitting Tolerance	0.03125 in. (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® Hand 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™ 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.

## Product Selection Guide

Product No.	Flex Type			Connection Type			
	Silver Ink on Polyester	Gold/Copper on Polyester	Gold/Copper on Polyimide	Flex to Glass	Flex to Plastic Device	Flex to PCB	Flex to Flex
ACF 5653			X			X	X
ACF 7303	X	X	X	X <sup>1</sup>	X <sup>2</sup>	X	X
ACF 7371	X	X	X	X	X		X
ACF 7378		X	X			X	X
ACF 7371-20	X	X	X	X	X		X
ACF 7376-10	X	X	X	X	X	X	X
ACF 7376-30	X	X	X	X	X	X	X
ACF 7379	X	X	X	X			

<sup>1</sup>Tested only for silver frit; not suitable for ITO traces.

<sup>2</sup>Suitable for silver ink traces only, not suitable for ITPO traces.

## Application Ideas

3M™ Electrically Conductive Adhesive Transfer 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.

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## Certification/Recognition

**MSDS:** 3M has not prepared a MSDS for this product which is not subject to the MSDS requirements of the Occupational Safety and Health Administration's Hazard Communication Standard, 29 C.F.R. 1910.1200(b)(6)(v). When used under reasonable conditions or in accordance with the 3M directions for use, the product should not present a health and safety hazard. However, use or processing of the product in a manner not in accordance with the directions for use may affect its performance and present potential health and safety hazards.

**TSCA:** This product is defined as an article under the Toxic Substances Control Act and therefore, it is exempt from inventory listing requirements.

**RoHs Complaint/REACH Compliant:** This product complies with the European Union's "Restriction of Hazardous Substances" (RoHs) initiative and with European REACH regulations 2002/95/EC and 2005/618/EC.

## 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, 3M Center, Building 225-3S-06, 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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