3M™ Electrically Conductive Adhesive Transfer Tape 9707

Product Description

3M™ Electrically Conductive Adhesive Transfer Tape (ECATT) 9707 is a pressure sensitive adhesive (PSA) transfer tape with isotropic electrical conductivity. The PSA matrix is filled with conductive fillers that allow interconnection between substrates through the adhesive thickness (the "Z-axis") and also provides electrical conductivity in the plane of the adhesive ("X-Y Axis").

3M ECATT 9707 and 9707K are ECATT products produced at different manufacturing locations. 3M ECATT 9707 and 9707K use similar base material types, however the ratios were adjusted slightly to achieve desired manufacturing specification performance results as determined by 3M test methods.

Features and Benefits

- Good XYZ electrical conductivity performance with good adhesion
- Room temperature application and assembly
- Inherent EMI shielding capability can enhance existing shielding solutions, offer new design options and improve Faraday cage designs
- Provides an electrical connection and adhesively bonds EMI/RFI shields and gaskets to metal frames and enclosures
- Low contact resistance and tape construction for good EMI performance
- Can be applied as die cut parts or in roll form
- Can offer lower contact resistance to hard surfaces or surfaces with oxide layers, such as to stainless steel as compared to 3M ECATT 9709

Construction

Property	Value
Adhesive Type	Filled Acrylic Pressure Sensitive
Release Liner	Std PET/PET Liners
Approximate Thickness	
Adhesive	2 mil (50 µm)
Liner(s)	2 mil (50 µm) PET / 2 mil (50 µm) PET

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:[Note 6]

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	1 Hour	24 Hours
23°C	32.5 oz./in. (3.6 N/cm)	55 oz./in. (6.0 N/cm)

Note: Peel values will often be higher than noted above when using a non-PET backing. Different backing types affect the backing modulus, thickness and stiffness and these differences directly affect the peel test result value. As an example, a 2 mil aluminum backing will change the test value of the peel adhesion. This is because the angle of the peel back at the interface will change due to the backing stiffness. A 2 mil aluminum backing would generally increase the peel values.

Temperature Performance[Note 1]	Application Use Temperatures: -40 to +85°C Varies with application design. See Note 1. 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.

Electrical Properties:[Note 6]

Current Carrying Capacity[Note 3]	To be qualified by end use customer
Z-Axis Resistance @ 1 Hr dwell, 2mm x 5mm contact area[Note 1,2,4,5]	<0.5 ohms
Minimum Overlap Area	Application dependent

Thermal Performance:[Note 6]

Apparent Thermal Conductivity	0.6 - 0.7 W/mk

Note 1 Application use temperature range of the 3M™ Electrically Conductive Adhesive Transfer Tape 9707 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 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 good performance of the 3M ECATT 9707 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, etc. (See section on mechanical clamping for added information).

Note 2 Two wire resistance measurement (a 4 wire test would generally be lower). The Z axis test uses a test PCB with gold traces or pads that are 2mm wide. The ECATT tape is laminated to a polyimide or PET flex with a gold plating. The ECATT is laminated to the flex to cover about 50% of the flex surface. The flex/ECATT is bonded to the PCB gold pad and the opposite (non-ECATT end) is placed into contact with another gold PCB trace to make an electrical contact. Contact R is measured between the two PCB pads of the flex to infer a relative contact R of the ECATT product based on this test method and surfaces used.

Note 3 Estimated. Customers are required to qualify the maximum current capability for their application. Added compression in bond line suggested for any current carrying application to improve reliability. See also Note 1

Note 4 Minimum suggested 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.

Note 5 Z & XY conductivity end use and testing results will vary based on many factors such as, but not limited to: End use design, environmental conditions, aging environment, test methods, interface material types & compatibility, product lot to lot & with-in lot variability, XY span, surface features & topography, area, surface preparation, etc.

Note 6 3M ECATT 9707 and 9707K are ECATT products produced at different manufacturing locations. 3M ECATT 9707 and 9707K products use similar base material types, however the ratios were adjusted slightly to achieve desired manufacturing specification performance results as determined by 3M test methods.

Available Sizes

Slit Tape Width	Standard Length	Maximum Length
1.0 to 12 inch (25 mm to 354 mm)	36 yds. (32.9 m)	108 yds. (98.8 m)
Normal Slitting Tolerance	0.065 in. (0.8 mm)	

Application Techniques

Note: As each application is unique, it is important for users of the 3M ECATT products to evaluate which will work best for their product design. In some designs, 3M™ Electrically Conductive Adhesive Transfer Tape (ECATT) 9709 may perform as effectively as 3M ECATT 9707 for EMI shielding when a final design is tested for electromagnetic interference compatibility (EMC).

3M ECATT 9707 is a more surface aggressive ECATT on many substrates, which will allow for a higher level of adhesion build (as measured by a peel adhesion test method and as compared to the 3M ECATT 9709S). Because 3M ECATT 9707 is a more surface aggressive ECATT tape, it is generally not compatible with Indium Tin Oxide (ITO) coating or other easily corroded surfaces.

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

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 ECATT 9707 and to engage the conductive particles with the substrates to make electrical connection. Mechanical pressure (roller, metal bar) or finger pressure at 5 to 15 psi (0.03 to 0.10 Mpa) is suggested at 20°C (68°F) to 25°C (77°F). The end user may find through testing that a higher pressure could be more effective in their end-use design to meet their specific design criteria. Heat may be applied simultaneously to improve wetting and final bond strength. **See Note A.**
- 3M ECATT 9707 is suggested to be applied at a maximum temperature range not to exceed 15°C - 70°C (60°F - 158°F). Tape application below 10°C (50°F) is not suggested because the adhesive will be too firm to wet the surface of the substrate, resulting in low adhesion. **See Note A.**
- Adhesion builds with time. Up to 24 to 72 hours may be required to reach final adhesion values.

Note A) Regarding the application of Temperature, Pressure and Time (T-P-T) during assembly and/or lamination: Care must be taken by the end user during assembly as the modulus of the tape will be reduced with the application of heat.

- An application method with ranges of not more than: 5-15 psi @ 15-70°C for 2-30 seconds is suggested as a set of initial evaluation ranges. An example of initial T-P-T that may be evaluated is: 8 psi applied via an assembly fixture using an air actuated pressure pad (pad is a medium firm elastomer) for 5 seconds @ 23°C. The end user may find assembly T-P-T outside these limits works well in their unique application. The noted T-P-T is a suggested starting point of tape bonding criteria and will be influenced by 3M ECATT 9707 part size, substrate types, substrate modulus, surface features, flatness, assembly fixtures, etc.
- Final bond strength and conductive performance will be impacted by “Temperature-Pressure-Time” interactions in an end use assembly method to the desired substrates.
- Care must be used to minimize excessive “Temperature-Pressure-Time” assembly methods so the conductive filler/acrylic adhesive matrix is not damaged, leading to poor performance (ie: excessive squeeze-out of tape, filler-interface damage, minimize over compression and conductive filler/adhesive matrix damage.)
- A Design of Experiments (DOE) is suggested to establish the optimum bonding conditions for each application assembly.

Application Techniques (continued)

Mechanical Clamping

To assure electrical resistance stability of 3M™ Electrically Conductive Adhesive Transfer Tape (ECATT) 9707 in any flexible circuit interconnection application, or grounding application between various types of substrates, 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. A well designed mechanical clamp will reduce the environmental stress on the bond line, improve the electrical reliability of the bond, and improve the temperature operating range for the adhesive, helping to ensure the conducting particles in the 3M ECATT 9707 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 3M ECATT 9707 is more sensitive to environmental changes than is the peel adhesion performance. Contact resistance performance may be compromised, even if holding power is not significantly affected. See Note 1 in “Electrical Properties” section. The user is responsible for the environmental performance qualification of 3M ECATT 9707 in their design.

Rework

Mechanically separate the parts using torque (for rigid parts) and peel (for flexible parts). Remove the adhesive by rubbing it off with a Scotch-Brite™ Hand Pad, clean up the site, and apply new adhesive. Heating the adhesive to 70°C - 100°C (158°F - 212°F) or using solvents can soften the adhesive and reduce the force needed to separate the parts.*

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

General Application Guide

3M has a broad line of Electrically Conductive Adhesive Transfer Tapes (ECATT) that vary in conductive filler types, filler loading design, adhesive chemistry, storage modulus of the conductive tape, adhesion to various surface types, thickness, conformability, etc. 3M provides a variety of tape products to allow end-users more options to optimize grounding, EMI shielding and interconnects based on product attributes.

As each end use application has many variables unique to the design, it is suggested that 2 or more products be tested in a Design of Experiments (DOE) to identify the best performing product for the application along with the optimum assembly means (pressure, time, temperature, assembly fixtures, etc.) and final design configuration for desired end use performance.

End-use substrate surfaces, final assembly design specifications, design configurations, assembly methods and end use environmental conditions will vary. For example:

a) When evaluating 3M ECATTs, note that the surface energy of the design substrates to be evaluated will vary in surface energy, which can impact the adhesion strength of the tape to the surfaces (i.e. stainless steel vs. polyimide vs. gold vs. nickel plating, etc.).

b) Substrate surface hardness and inherent conductivity can affect potential filler/surface contact resistance (i.e. stainless steel vs. polyimide vs. gold vs. silver epoxy ink vs. plated surfaces, etc.).

c) Modulus or flexibility of the substrates can affect substrate interaction with the 3M ECATTs and environmental aging performance (i.e. rigid PCB vs. flex circuit vs. metals vs. substrate thickness, etc.).

d) Contact area for grounding on a substrate can impact the effective contact resistance level achieved in a design (Total contact area [3mm^2, 25mm^2, 100mm^2, etc.] and discrete sizes of individual contact areas [3mm^2, 10mm^2, 30mm^2, etc.].)

e) Substrate surface topography or surface features can impact how the tape can “gap fill” or “conform to irregularities” and provide adhesion and conductivity between substrates.

f) Bond line stress in the form of a tensile, cleavage, compression and shear can all affect 3M ECATT performance in an application (i.e. rigid to rigid substrates, multi-layer flex to rigid, thin flex to rigid, etc.).

g) Method of assembly and size of finished parts can affect tape selection (ease of converting and assembly based on die cut part shape and final assembly).

h) Desired contact resistance level varies. For example, some applications specification may indicate a contact R <100ohms or R < 10ohms or R <1.0ohms target. Each design has its own resistance specification, and within a design, each area can have a different resistance level need.

i) Environmental conditions vary (i.e. minimum and maximum temperatures, cycling, humidity, etc.).

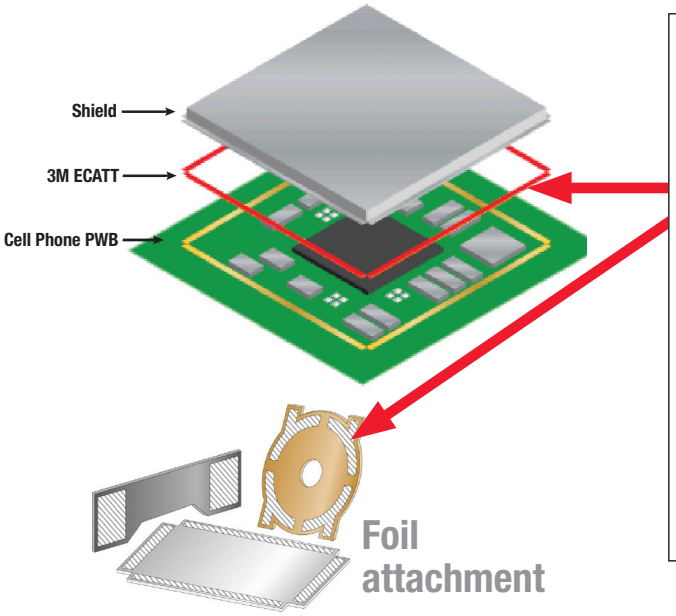
j) Assembly methods affect final performance of the tape with the given substrates (tooling, fixtures, assembly pressure-temperature-time).

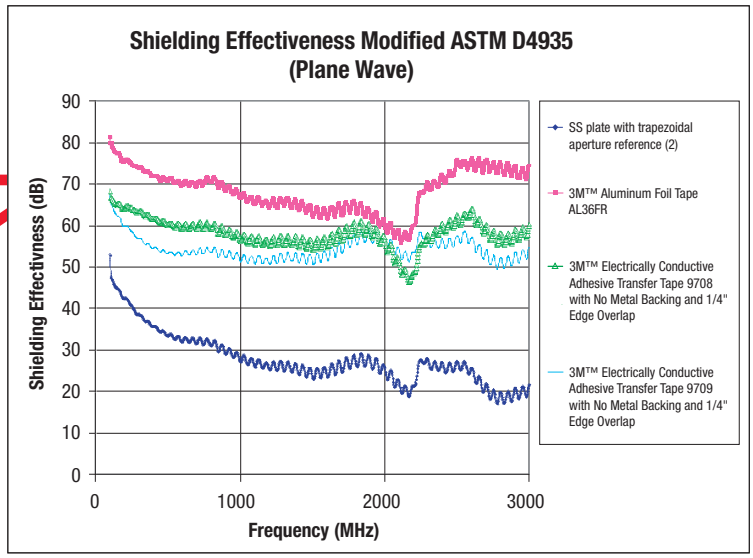
k) Final assembly configuration will also vary (i.e. inherent bond line compression, clamping, stand-alone assembly, etc.).

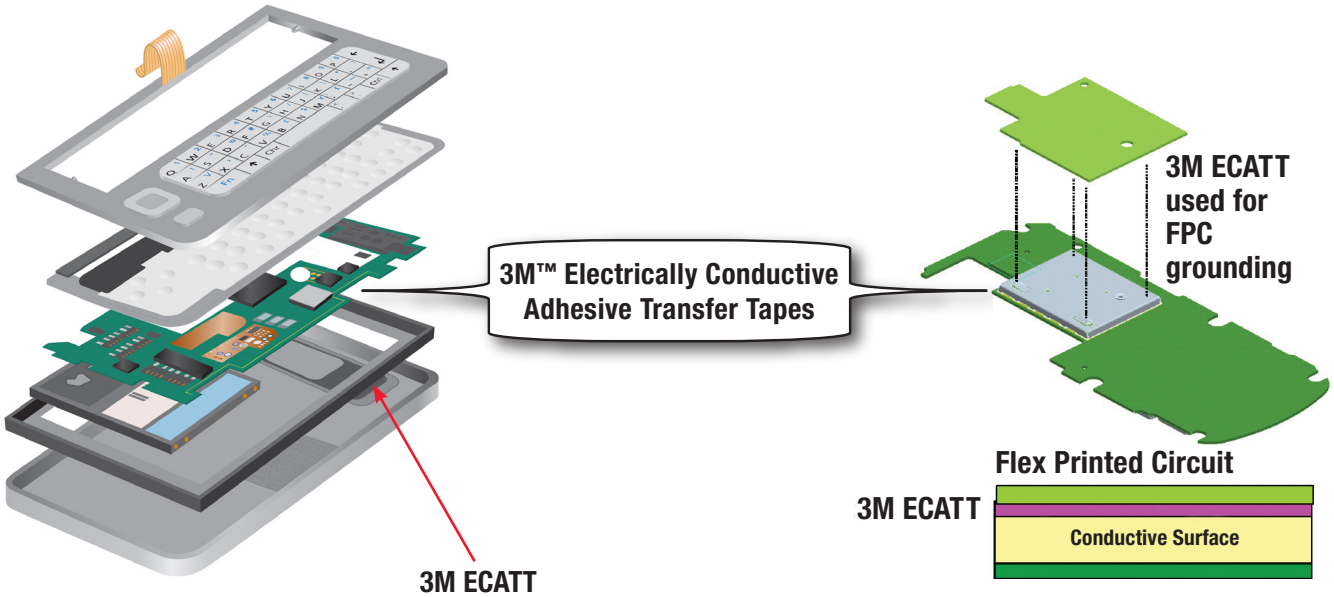
The above end use application variables make it difficult to predict which 3M ECATT will best achieve the desired level of performance in an application. Thus, 3M has a broad and unique line of conductive tapes to provide a blend of performance characteristics to evaluate for each application.

3M™ Tape Application Benefits

3M™ Electrically Conductive Adhesive Transfer Tapes (ECATT provide grounding and EMI shielding through the bond line thickness leading to improved product EMI shielding performance. 3M ECATT 9707 may provide EMI shielding in the bond line, but actual performance depends on the final design tape width.







Application Ideas

3M™ Electrically Conductive Adhesive Transfer Tape (ECATT) 9707 is ideal for EMI/RFI shield and gasket attachment applications, and grounding applications. It is also ideal for larger Z-axis connections when die cut for each Z-axis connection. Applications include EMI shields for displays and gasket attachment to EMI/RFI cabinets and enclosures.

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.

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3M

Electronics Materials Solutions Division
3M Center, Building 225-3S-06
St. Paul, MN 55144-1000
1-800-251-8634 phone
651-778-4244 fax
www.3M.com/electronics

60-5002-0350-4