Selection of Grounding, EMI Shielding and Attachment
3M™ Electrically Conductive Adhesive Transfer Tapes (ECATT)

General Description
This technical bulletin describes a decision process flow to narrow and select the 3M™ Electrically Conductive Adhesive Transfer Tapes (ECATT) for a grounding, EMI Shielding and attachment applications.

ECATT Selection Process Overview
The process for the selection of a set of ECATT products to test in a given end use application is defined by the answers to a series of application questions. Understanding how potential answers influence the end use application electrical/grounding/EMI Shielding performance and the end use application’s primary assembly function leads to a set of products that can be tested for an application.

The selection process also ensures the design team understands the multi-functional aspects of ECATT selections that impact specific attributes of the application. The process also educates the design team member on the “why” of a selection may be important to one member and less important to others (ie: One engineer selects an ECATT for adhesion for assembly strength or a “mechanical” function, while the second engineer selects the ECATT for contact grounding resistance to ensure “electronics” function of the design).

ECATT General Design Guide Categories

- Define Substrate Surfaces
  - Gold-SS-Aluminum-Copper-Scrim

- Define Contact Resistance
  - R = <1, 1-5, 5-20, >20 ohms

- Define Bond Line EMI Shielding Requirement
  - Gap-Slit Shielding

- Define Environment
  - Temperature Range

- Define Bond Line Thickness
  - t = 1.5 - 8.0 mils

- Define Adhesion Strength
  - Good – Better – Best

- Define Contact Area
  - X-Y, Total Area

- Define Assembly Process
  - Pressure-Time-Temperature
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The substrate surface types are characterized by a surface resistance, hardness & topography. These features influence how the conductive aspects of the 3M™ Electrically Conductive Adhesive Transfer Tape (ECATT) solution will interface with these surfaces to achieve a final assembly with associated contact resistance, peel strength, etc. Each ECATT type “conductive filler” (particles, non-woven’s, etc.) interact with the substrate surfaces to allow for a contact resistance.

The ECATT’s are designed to provide for different contact resistance based on the substrate types. The contact resistance value (ohms) will lead to different performance aspects of the final assembly and device.

Assembly contact resistance can effect:

- Assembly electrical bias or EMI Shielding Performance as ECATT grounds the EMI shield
- Bias can generate antenna or RF signal affects that can lead to lower performance of device
- Lower R can allow for improved EMI shielding of a design. 3M™ Electrically Conductive Adhesive Transfer Tape (ECATT) 9709S-9707 has “inherent” bond line EMI shielding in addition to excellent grounding for improved high frequency performance.

**Define Substrate Surfaces**
Gold-SS-Aluminum-Copper-Scrim

**Define Contact Resistance**
\[ R = <1, 1-5, 5-20, >20 \text{ ohms} \]

**Problem**
Electrical Bias Degrades Performance

**Solution**
Effectively Ground Device

If device is not well grounded, the “bias” voltage in the device acts as a “transmitter” of a signal that the signal line flex, antennae flex, etc. pick up, leading to poor performance.

Device is well grounded so the “bias” voltage in the device is “baseline” and no “RF signal” is emitted.
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Define Environment
Temperature Range

The environmental conditions can influence the 3M™ Electrically Conductive Adhesive Transfer Tape (ECATT) contact R and adhesion performance. Environmental conditions may impact contact resistance performance as the environmental conditions lead to modulus changes in the adhesive that can change the “effective” contact of the conductive filler type to a surface. See Data page for detailed information.

Define Bond Line EMI Shielding Requirement
Gap-Slit Shielding

ECATT products can have varying degrees of EMI shielding in the “bond line” “gap slit” due to the conductive filler type. 3M™ Electrically Conductive Adhesive Transfer Tapes (ECATT) 9709SL, 9709S, 9707, 9709 have a high degree of EMI Shielding in the “bond line” leading to improved EMI Shielding and grounding performance and reduced EMI affects.

• Problem
Higher frequencies require optimized grounding and Faraday Cage design

• Solution
Inherent bond line EMI shielding

3M™ Electrically Conductive Adhesive Transfer Tape 9709SL used for Flex PC grounding and EMI Shielding

Stackup

Conductive Surface

Flex 3M™ 9709SL

Grounding Surface

3M™ Electrically Conductive Adhesive Transfer Tape (ECATT) 9709SL

S

Complete Environment
Temperature Range

Define Bond Line EMI Shielding Requirement
Gap-Slit Shielding

3M™ Electrically Conductive Adhesive Transfer Tape 9709SL used for Flex PC grounding and EMI Shielding

Stackup

Conductive Surface

Flex 3M™ 9709SL

Grounding Surface

3M™ Electrically Conductive Adhesive Transfer Tape (ECATT) 9709SL

S

60dB EMI Shielding

60dB EMI Shielding

Metal Thickness

Effective Gap / Slit does not = “0”. EMI energy escaping due to bond line Gap/Slit

@ High Frequencies, small gap/slits allow EMI leakage

Low gap EMI shielding leads to lower EMI SE

Effective Gap / Slit does not = “0”. EMI energy escaping due to bond line Gap/Slit

@ High Frequencies, small gap/slits allow EMI leakage

60dB EMI Shielding

Metal Thickness

Effective Gap / Slit does not = “0”. EMI energy escaping due to bond line Gap/Slit

@ High Frequencies, small gap/slits allow EMI leakage

10Hz 0.1mHz 50mHz 1000mHz (1GHz) 10000mHz (10GHz)

Gap Size or Slit Length

Standard Electrically Conductive Adhesive Transfer Tape

3M ECATT with inherent EMI shielding at the bond line provides significantly reduced crosstalk, stray EMI, noise in circuit, antennae effects, FPC susceptibility and spurious emissions.
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Define Adhesion Strength
Good – Better – Best
Rework

Define Bond Line Thickness
\[ t = 1.5 - 8.0 \text{ mils} \]

3M™ Electrically Conductive Adhesive Transfer Tape (ECATT) products vary in thickness to meet defined gap requirements. Adhesion is achieved through adhesive type and bond line thickness. Adhesion can range from “standard” type adhesion that can allow easier rework and good assembly performance. High adhesions ECATT’s provide for greater holding strength. Enhanced reworkable ECATT’s have a High Adhesion and Low Adhesion sides to the ECATT to enhance rework.

Define Assembly Process
Pressure-Time-Temperature

Each design will require a Design of Experiment (DOE) to determine an optimum assembly method for Time-Temperature and Pressure of the ECATT assembly.

Key Application Questions:

a) What surfaces?
   • SS, Gold, Nickel

b) What Contact R?
   • <1 ohm, 1-5, 5-20, >20 ohm

c) Will Inherent EMI shielding improve EMI Shielding performance?
   • 75% of applications YES

d) Thickness?

e) Adhesion level?
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ECATT Selection Options
Features – Advantages – Benefits

3M™ Electrically Conductive Adhesive Transfer Tapes (ECATT’s) offer a range of adhesive types, thickness and a range of conductive fillers. Working with the 3M representative, a design team can select 2-3 options to test for a given application and validate the final application performance.

<table>
<thead>
<tr>
<th>Product Number</th>
<th>Design</th>
<th>Type</th>
<th>Features - Advantages - Benefits</th>
<th>Contact R Flex to SS</th>
<th>Contact R Flex to PCB (Gold/Gold)</th>
<th>Bond Line EMI Shielding (Low Noise)</th>
<th>&quot;Well&quot; Flex Filling Potential</th>
<th>Adhesion</th>
<th>Rework</th>
<th>Thermal Conductivity (W/mK)</th>
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"Feature - Advantage - Benefit"
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(5)
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