



# Z-Axis Adhesive Film

## 5460R

Technical Data

June, 1999

### Product Description

3M™ Z-Axis Adhesive Film 5460R is a heat-bonded, electrically conductive adhesive film. It is a non-tacky, heat and pressure cured system consisting of an adhesive matrix randomly loaded with conductive particles. These particles allow interconnection of circuit lines 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.

3M Film 5460R electrically connects and mechanically bonds flexible printed circuits (Flex) – especially copper/polyimide (PI) circuits – to a wide variety of electronic substrates and metallizations, including printed circuit boards (PCB) and flexible circuits. Film 5460R is ideal for high performance systems requiring high electrical conductivity and high reliability, along with repairability.

### Construction and Design Guidelines

Property	Value
Adhesive Type	Cyanate Ester and Epoxy / Thermoplastic Blend
Particle Type	Gold plated nickel
Particle Size	7 micron
Liner Type	Polyester Film with Silicone release
Adhesive Thickness	40 micron
Liner Thickness	38 micron
Minimum Gap <sup>1</sup>	100 micron
Minimum Overlap Area <sup>2</sup>	0.065 mm <sup>2</sup>
Maximum Current <sup>3</sup>	100 mA / 0.1 mm <sup>2</sup>

1. Minimum free space (gap) between adjacent conductors to ensure electrical isolation. With proper circuit design and bonding process finer pitch applications may be qualified by the user.

2. Minimum conductor overlap area per conductor to ensure electrical connection in the Z-axis.

3. Maximum continuous loading current.

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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.**

### Ambient<sup>1</sup> Physical Properties

Property	Test Substrates <sup>2,3</sup>	Value	Test Method
Interconnect Resistance	PI Flex to PCB	≤ 0.05 Ω	IPC – 2.6.24
Insulation Resistance	PI Flex to PCB	≥ 10 <sup>12</sup> Ω	3M-8016 <sup>6</sup>
Peel Strength <sup>4</sup>	PI Flex to PCB	≥ 1000 g/cm	IPC – 2.4.9.1
Property	Value		
Modulus	2 x 10 <sup>10</sup> dyn/cm		
Coefficient of Thermal Expansion (< 120°C) <sup>5</sup>	50 to 80 ppm / °C		
Ionic Content	Chloride	< 0.4 ppm detection limit	
	Sodium	< 0.4 ppm detection limit	
	Potassium	< 9 ppm	

1. 25 ± 3°C and 65 ± 5% RH.

2. Au-plated 1 oz Copper / 75 micron Upilex polyimide/ 200 micron pitch.

3. Au-plated 1 oz Copper / 0.6 mm FR-4 / 200 micron pitch.

4. 90 degree peel. Peel performance depends upon the adhesive type in the three layer flex circuit construction. The user is responsible for qualifying peel performance of 3M 5460 with their flex circuitry.

5. Sample cured at 180°C for 30 minutes.

6. Test 3M-8016 is functionally equivalent to IPC-2.5.10.1 but uses a different test pattern.

### Reliability Performance

Test Conditions <sup>1,2</sup>	Condition	Maximum Interconnect Value (Ω) IPC – 2.6.24 <sup>5</sup>	Insulation Resistance (Ω) 3M-8016 <sup>6</sup>	Peel Value (g/cm) IPC – 2.4.9.1 <sup>4</sup>
100°C	1000 h	≤ 1	≥ 10 <sup>8</sup>	≥ 1000 g/cm
-40°C	1000 h	≤ 1	≥ 10 <sup>8</sup>	≥ 800 g/cm
60°C/95% RH	1000 h	≤ 1	≥ 10 <sup>8</sup>	≥ 1000 g/cm
-20 to 70°C/90% RH	120 cyl	≤ 1	≥ 10 <sup>8</sup>	≥ 1000 g/cm
-40 to 100°C	100 cyl	≤ 2	≥ 10 <sup>8</sup>	≥ 1000 g/cm
85°C/85% RH (50 VDC)	240 h <sup>3</sup>	≤ 1	≥ 10 <sup>8</sup>	≥ 1000 g/cm

1. Au-plated 1 oz Copper / 75 micron Upilex polyimide/ 200 micron pitch.

2. Au-plated 1 oz Copper / 0.6 mm FR-4 / 200 micron pitch.

3. Load 50 VDC between adjacent lines.

4. 90 degree peel. Peel performance depends upon the adhesive type in the three layer flex circuit construction. The user is responsible for qualifying peel performance of 3M 5460 with their flex circuitry.

5. Test equipment not able to resolve resistance changes 1Ω resistance.

6. Test 3M-8016 is functionally equivalent to IPC-2.5.10.1 but uses a different test pattern.

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<b>Available Sizes</b>	<b>Rolls:</b> 3.0 mm wide x 50 meters long 3.0 mm wide x 10 meters long  2.5 mm wide x 50 meters long 2.5 mm wide x 10 meters long (other widths may be custom ordered and are subject to availability)
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## Application Techniques      Bonding Conditions

Procedure	Conditions
Tacking Conditions	
Temperature*	80 - 100°C
Pressure	1 - 10 Kg/cm <sup>2</sup>
Time	2 - 5 seconds
Bonding Conditions	
Temperature*	170 - 190°C
Pressure	20 - 40 Kg/cm <sup>2</sup>
Time	20 - 30 seconds

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\*Temperature measured in the adhesive. Thermode set points will be higher and will depend upon the substrate materials and bond equipment.

Bonding of film 5460R requires a three part procedure: heat tacking the film to the flex circuit (or to the PCB etc.), removal of the release liner, and bonding the flex to the second substrate. Detailed bonding instructions are available in the “Notes on Bonding of 5000 Series 3M Z-Axis Films” Technical Service Bulletin, and these instructions must be followed to obtain good electrical and mechanical bonding.

A thermocompression (hot bar) bonder is required for use of film 5460R, and several commercially available models exist; a list of vendors can be obtained by calling the toll free number on the back of this Technical Data Sheet.

### Repair

Bonds made with film 5460R are repairable by heating the bondline to 100°C (eg. with a hot plate or rework tool) peeling the substrates apart. The bond site then requires cleaning with a solvent (Methyl ethyl ketone recommended), after which the circuit can be rebonded using a fresh piece of film 5460R.

**Note:** Carefully read and follow solvent manufacturer’s precautions and directions for use.

### Storage

Film 5460R should be kept frozen (-5°C/23°F) or refrigerated in the original metallized airtight shipping pouch. Prior to use, while still inside the shipping pouch, film 5460R should be allowed to warm to room temperature for approximately 30 minutes to prevent condensation on the film and possible adhesive cracking. Refrigerator stored materials have a shelf life of 3 months. Freezer stored materials have a shelf life of 12 months. Reels exposed to room temperature for more than 4 weeks accumulated time may exhibit handling problems such as cracking or flaking of the adhesive and separation of the adhesive from the liner. Lengths of film 5460R unwound from the reel may show this type of failure earlier. While in storage film 5460R should be kept away from direct sources of heat and light. Film 5460R should be protected from exposure to high humidity environments.

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## General Information

## ZAF Product Selection Guide

Product	Flex Type		Connection Type			Pitch		
	Silver Ink on Polyester	Copper on Polyimide	Flex to Glass	Flex to PCB	Flex to Flex	Moderate	Fine (≥ 100 micron)	Very Fine (≤ 100 micron)
9703	x	x		x*	x	> .76mm		
7303	x	x		x	x	> .50mm		
5352R		x	x				x	
5552R		x	x					x
5460R		x		x	x		x	

\*Requires mechanical backup for lowest electrical resistance

## Application Ideas

Film 5460R is suitable for a wide variety of Flex-to-PCB glass bonding applications. Possible applications include Flex-to-PCB for plasma display interconnection.

## Precautionary Information

Refer to product label and Material Safety Data Sheet for safety and health information before using this product. Minimize skin contact during handling and use. Refer to product's Material Safety Data Sheet for protective glove recommendations.

## For Additional Information

To request additional product information or to arrange for sales assistance, call toll free 1-800-362-3550. Address correspondence to: 3M Bonding Systems Division, 3M Center, Building 220-7E-01, St. Paul, MN 55144-1000. Our fax number is 651-733-9175. In Canada, phone: 1-800-364-3577. In Puerto Rico, phone: 1-809-750-3000. In Mexico, phone: 5-728-2180.

## Certificate/Recognition

Meets IPC 3408 General Requirements for Anisotropic Conductive Adhesive Films.

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

## Important Notice

3M MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of application. Please remember that many factors can affect the use and performance of a 3M product in a particular application. The materials to be bonded with the product, the surface preparation of those materials, the product selected for use, the conditions in which the product is used, and the time and environmental conditions in which the product is expected to perform are among the many factors that can affect the use and performance of a 3M product. Given the variety of factors that can affect the use and performance of a 3M product, some of which 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.

## Limitation of Remedies and Liability

If the 3M product is proved to be defective, THE EXCLUSIVE REMEDY, AT 3M'S OPTION, SHALL BE TO REFUND THE PURCHASE PRICE OF OR TO REPAIR OR REPLACE THE DEFECTIVE 3M PRODUCT. 3M shall not otherwise be liable for loss or damages, whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including, but not limited to, negligence, warranty, or strict liability.

**ISO 9002**

This Bonding Systems Division product was manufactured under a 3M quality system registered to ISO 9002 standards.



### Bonding Systems Division

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