



Anisotropic Conductive Film Adhesive

7313

Technical Data

August, 2004

Product Description

3M™ Anisotropic Conductive Film (ACF) Adhesive 7313 is a heat-bondable, electrically conductive adhesive film. It is essentially non-tacky at room temperature and consists of a thermoplastic adhesive matrix randomly loaded with conductive particles. These particles allow interconnection of circuit lines through the adhesive thickness, but are spaced far enough apart for the product to be electrically insulating in the plane of the adhesive. Application of heat and pressure causes the thermoplastic to flow and to bring the circuit pads into contact by trapping the conductive particles. Upon cooling, the thermoplastic crystallizes and provides mechanical strength. No cure takes place. ACF 7313 may be used to bond a flexible printed circuit to another flexible printed circuit or to a printed circuit board.

Construction and Design Guidelines

Property	Value
Adhesive Type	Polyether-amide
Particle Type	Silver-coated glass
Particle Size	43 microns
Liner Type	Polyester Film with Silicone Release
Adhesive Thickness	63 microns
Liner Thickness	50 microns

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.

Property	Value	Units
Minimum Space Between Conductors	250 (10)	micron (mil)
Minimum Overlap Area	0.75 (1200)	mm ² (mil ²)
Temperature Cycling Range*	-20 to 80 (-4 to 176)	°C (°F)

*Long term outdoor use may require additional reinforcement.

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Typical Physical Properties and Performance Characteristics (continued)

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

Ambient Physical Properties

Property	Test Substrates	Value	Units
Interconnect Resistance ⁽¹⁾	Flex to PC board ⁽²⁾	< 0.1	Ohms
Insulation Resistance	Flex to glass ⁽³⁾	$\geq 10^{10}$	Ohms
Peel Strength ⁽¹⁾	Flex to PC board ⁽²⁾	≥ 1000	gf/cm
Modulus ⁽⁴⁾		1×10^6	Pa

(1) For a given application, values may differ depending on particular flex circuit and PCB board materials used.

(2) Measured for silver ink/polyester flex circuits bonded to solder-coated copper/FR-4 PC board. Contact overlap area was 0.75 sq. mm. Pad pitch was 500 microns.

(3) The insulation resistance measurement was made using gold-coated copper/polyimide flex circuits bonded to glass. Circuit line spacing was 0.19 mm. Bias voltage was 50V. Circuit line thickness was 0.058 mm.

(4) Storage shear modulus from dynamic mechanical analysis measured at 25°C using 1 rad/sec.

Reliability Performance

Test Conditions	Interconnect Resistance ^(5,6) (Ω) IPC 2.5.4
25°C x 1 year	< 0.1
80°C x 1000 hrs	< 0.1
-40°C x 1000 hrs	< 0.1
60°C/95% RH x 1000 hrs	< 0.1
70°C/95% RH x 1000 hrs	< 0.1
-40 to 80°C x 500 cycles	< 0.1

(5) For a given application, values may differ depending on particular flex circuit and PCB board materials used.

(6) Measured for silver ink/polyester flex circuits bonded to solder-coated copper/FR-4 PC board. Contact overlap area was 0.75 sq. mm. Pad pitch was 500 microns.

Assembly Process Techniques

Procedure	Conditions
Tacking Conditions	
Temperature ⁽⁷⁾	~100°C
Pressure	1 - 15 Kg/cm ²
Time	~1 seconds
Bonding Conditions	
Temperature ⁽⁷⁾	140°C
Pressure	~15 Kg/cm ²
Time ⁽⁸⁾	8-12 seconds

(7) Temperature measured in the adhesive. Thermode set points will be higher and will depend upon the substrate materials and bond equipment. A typical bonding set-up for a flex interconnect bond is a thermode temperature of 200°C and a bonding time of 8-12 seconds (see next note).

(8) Adhesive requires approximately 5 seconds bond time after required adhesive temperature of 140°C is reached to make the electrical connection. Also, it may be desirable to hold pressure while cooling for maximum performance. Total bond time includes the time to ramp to required bond temperature (2-3 seconds), the 5 second hold at bond temperature, and cool-down time. The cool-down time will require hold until temperature is lowered to below 90°C which is highly dependent on the type of bonder used.

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Assembly Process Techniques (continued)

A source of heat and pressure, such as a thermo-compression (hot bar) bonder is required for use of 3M™ Anisotropic Conductive Film Adhesive 7313. 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.

Bonding of ACF 7313 requires a three-part procedure:

- heat tacking the film to one substrate (pre-tacking)
- removal of the release liner
- bonding the first substrate to the second substrate.

The pre-tacking step is needed because this adhesive does not have significant tack at room temperature. A pre-tacking temperature of 85-105°C under a pressure of 1-15 Kg/cm² has been found to be effective.

Final bonding must be done under heat and pressure, with a typical desirable bond line temperature at or above 140°C, and a pressure of 14-17 Kg/cm². Heating the thermoplastic adhesive above the crystalline melting point allows the adhesive to flow and wet out the surface, and enables electrical contact to be made. During bonding, electrical contact is typically achieved within the first second after the bond line reaches 140°C. Additional time at temperature is desirable to increase the peel strength and the ultimate reliability. An 8 second bond time, with at least 5 seconds >140°C may be used as a starting point in developing a bond profile. Bond times may vary depending upon the substrates to be bonded. For maximum mechanical and electrical performance, the pressure should be maintained while cooling to below 90°C. This increases the total bond time. The time required to drop adhesive bond-line temperature below 90°C is highly dependent upon the bonding equipment used. After removing the thermode pressure (and heat), the adhesive quickly re-crystallizes. Maximum adhesion strength is achieved about 24 hours after bonding.

Repair

Bonds made with ACF 7313 are repairable by heating the bond-line to 140°C (e.g. with a hot plate or rework tool) and peeling the substrates apart. The bond site then requires cleaning with a solvent, after which the circuit can be re-bonded using a fresh piece of ACF 7313. Solvents such as Methyl Ethyl Ketone or a 50:50 blend of n-Butanol:Toluene may also be used. **Note:** Carefully read and follow the solvent manufacturer's precautions and directions for use.

Storage

ACF 7313 requires room temperature storage, and has a shelf life of at least 24 months upon receipt by the customer. ACF 7313 should be stored away from high humidity environments as absorbed water can lead to moisture volatilization producing bubbles during heat bonding.

Available Sizes

Rolls: 2.5 mm (0.1 in.) wide x 25 m (22 yds.) long,
5.0 mm (0.2 in.) wide x 25 m (22 yds.) long.

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General Information

3M™ Anisotropic Conductive Film 7313 mechanical and electrical performance meets or exceeds the performance of silver-ink polyester flexible circuits in environmental testing. ACF 7313 has shown good electrical stability in high humidity testing such as 70°C/95% RH. The data contained in the Typical Physical Properties and Performance Characteristics Tables was obtained on specific flex to PC board interconnections, and the results in a customer application may differ. For specific performance information, please contact your 3M Technical Service Representative.

3M™ Anisotropic Conductive Film (ACF) Produce 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	>0.76mm		

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

†Requires mechanical backup for lowest electrical resistance.

Other Applications

ACF 7313 may be used to connect and bond flex circuits to touch panels for touch screen displays. The conductor traces on the glass panels are made using silver frit. The minimum conductor spacing is 0.25 mm (10 mil) and the minimum pad overlap is 0.75 mm² (1200 mil²). ACF 7313 is ideal for a wide variety of electronic interconnection applications in particular where fast bond times are required.

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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 651-733-9175. In Canada, phone: 1-800-364-3577. In Puerto Rico, phone: 1-787-750-3000. In Mexico, phone: 52-70-04-00.

Please examine our entire line of conductive products for electronics at:
www.3m.com/electronicmaterials

Certification/ Recognition

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

Product Use

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Industrial Business Electronics Markets Materials Division

3M Center, Building 21-1W-10, 900 Bush Avenue
St. Paul, MN 55144-1000
1-800-251-8634 phone
651-733-9175 fax
www.3M.com/electronicmaterials



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