



Flexible Copper Laminates

PRODUCT DESCRIPTION

Shin-Etsu is the world's largest supplier of semiconductor silicon and chemicals to the semiconductor industry, synthetic quartz glass and PVC. Flexible copper-clad laminate materials (FCL) are one of the many product lines Shin-Etsu has developed. Base polyimide films are 1/2 mil. through 5 mil. thick with Cu ranging from 1/2 to 2 oz. All of our FCLs and coverlays are registered as UL certified materials, and are manufactured in ISO 9002-certified plants.

FCL and coverlay films are the primary materials used in the construction of flexible printed circuit (FPC) boards. FCL is copper laminate in which the conductor (copper) is laid as a base for dielectric film.

PROPERTIES

- Uniform and stable adhesion of the copper foil to the base film.
- Soldering, heat-resistance temperature < 350° C.
- Excellent dimensional stability is maintained throughout the entire FPC manufacturing process.
- The outstanding flexural fatigue resistance makes it ideal for small-radius settings and reciprocating motion.
- Superior Electrical characteristics.



Flexible Copper Laminates

FCL TYPICAL PROPERTIES

PROPERTY	UNIT	RAR32S58	RAR32D58	RAR33S58	RAR33D58	TEST METHOD
Product Composition						
Polimide Film	-	Kapton 1 mil	Kapton 1 mil	Kapton 1 mil	Kapton 1 mil	-
Copper Foil	-	1/2 oz-RA	1/2 oz-RA	1 oz-RA	1 oz-RA	-
Adhesive	µm	10	10	10	10	-
No. of sides of foil	-	1	2	1	2	-
Thickness	µm	53	81	70	115	-
Peel Strength	N/cm	9.3	12.3	10.3	12.3	JIS C 6471
Resistance to soldering heat	°C	330	330	330	330	JIS C 6471
Volume Resistance	W·cm	2.2x10 ¹⁶	1.4x10 ¹⁶	1.6x10 ¹⁶	1.0x10 ¹⁶	JIS C 6481
Surface Resistance	W	2.0x10 ¹⁶	1.8x10 ¹⁶	1.5x10 ¹⁶	1.0x10 ¹⁶	JIS C 6481
Insulation Resistance	W	1.5x10 ¹³	1.0x10 ¹³	1.5x10 ¹³	1.0x10 ¹³	JIS C 241
Dielectric Stability	-	3.2	3.3	3.2	3.3	JIS C 6481
Dielectric Dissipation Factor	-	0.03	0.03	0.03	0.03	JIS C 6481
Dimensional Stability	%	MD -0.08 TD +0.02	MD -0.11 TD +0.01	MD -0.08 TD +0.01	MD -0.10 TD +0.01	JIS C 6471
Flexural Fatigue MT*	times	MD 360 TD 350	MD 320 TD 270	MD 320 TD 340	MD 280 TD 320	JIS C 6471
Chemical Resistance**						
Acetone	-	Good	Good	Good	Good	JIS C 6481
Toluene	-	Good	Good	Good	Good	JIS C 6481
MEK	-	Good	Good	Good	Good	JIS C 6481
5% NaOH	-	Good	Good	Good	Good	JIS C 6481
Flame Retardancy (Designation)	-	V-0 (RAF-5)	V-0 (RAF-5)	V-0 (RAF-5)	V-0 (RAF-5)	UL 94

* Radius = 0.8, Tension = 4.9N

** Dipped for 15 minutes at room temperature

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Grade	CA-3-1 CA231	CA-3-1 CA333	CA-3-1 CA338	CA-3-1 CA433	CA-3-1 CA438	CA-3-1 CB335	E33
Material composition							
Polyimide film mil	½	1	1	2	2	1	-
Adhesive µm	15	25	50	25	50	35	25
Peel strength, lb/in							
As received	3.6	5	5	7.8	7.3	5	6.7
After solder float	3.6	5	5	7.8	7.3	5	6.7
Chemical resistance, %							
Isopropyl alcohol	90	90	90	90	90	90	90
Toluene	90	90	90	90	90	90	90
MEK	90	90	90	90	90	90	90
2N-HCl	90	90	90	90	90	90	90
2N-NaOH	90	90	90	90	90	90	90
Dimensional stability, %							
Method A	-0.27	-0.12	-0.18	-0.12	-0.15	-0.16	N/A
Solder float							
Method A	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Method B	Pass	Pass	Pass	Pass	Pass	Pass	Pass
Insulation resistance, MΩ	107	107	107	107	107	107	106
Flammability (UL94) V-0	Pass	Pass	Pass	Pass	Pass	Pass	-

N/A: Not Applicable

Remarks: 1) Test pieces were constructed by laminating the test material on the shiny surface of ED copper.

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APPLICATION



As indicated by the name, flexible circuit boards can bend freely along the curves of the products of which they are the components. FPCs are used for various electric and electronic products such as cameras, notebook PCs, mobile phones, HDDs, FDDs and CD-ROM drives. As these products become increasingly compact, their circuits must allow electric signals to flow within a very limited space.

PERFORMANCE

The copper foil and polyimide film used in our FCL materials is laminated using a proprietary and unique process, yielding improved peel strength, greater dimensional stability and excellent flexural endurance.

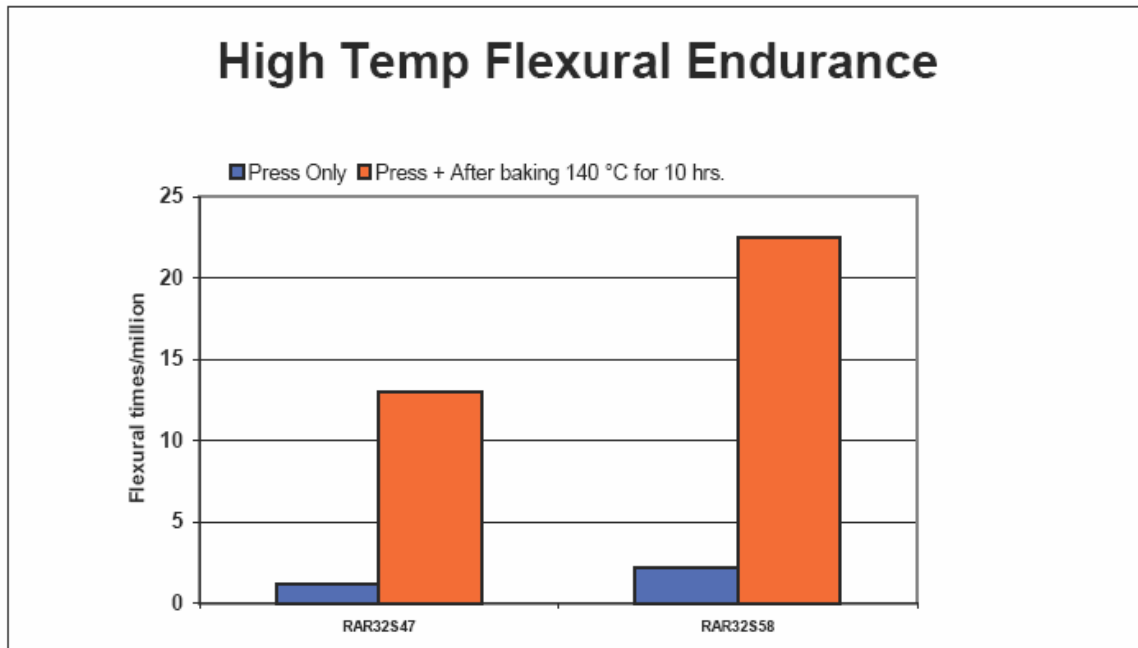
Shin-Etsu MicroSi's FCL provide a higher resistance to soldering heat, (>330°C) as compared to other epoxy based laminates. Our Coverlay materials can be processed at lower temperatures (160°C) and have higher flexural endurance.

Our material is UL approved (UL V-0) and is suitable for commercial circuits.

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Flexural Endurance

The following chart details the improved flexural performance of our 58-series laminates at high temperature.



1. Sample

- RAR32S47/CA333
- RAR32S58/CA333

Press Conditions

160 °C x 50 kg/cm² x 30 min.

2. After bake treatment

140 °C x 10 hours

3. Measurement Conditions

a. Flexural Conditions:

- Measurement Device
- Flexural Radius
- Stroke
- Flexural Speed

SEK-31B4S (made by Shin-Etsu Engineering)

2.0 mm

20 mm

2000 times/min

b. Measurement Temperature

60 °C

c. Specimen Setting

Coverlay is set inside

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Copper Laminate, Coverlay & Adhesive Selection Guide

Standard Products

Part Number	Width (in)	Total Thickness		Polyimide Thickness		Copper Foil Thickness		Adhesive Thickness	
		µm	mil	µm	mil	µm	oz	µm	mil
Single Sided Flexible Copper Laminates									
RAR32S58-18	18	53	2.1	25	1.0	18	0.5	10	0.4
RAR33S58-18	18	70	2.8	25	1.0	35	1.0	10	0.4
Double Sided Flexible Copper Laminates									
RAR32D58-18	18	80	3.2	25	1.0	18	0.5	10	0.4
RAR33D58-18	18	115	4.5	25	1.0	35	1.0	10	0.4
Coverlay Material									
CA231-18	18	28	1.0	12.5	0.5			15	0.6
CA233-18	18	37.5	1.5	12.5	0.5			25	1.0
CA333-18	18	50	2.0	25	1.0			25	1.0
CA333-24-100M	24	50	2.0	25	1.0			25	1.0
CA335-24	24	60	2.5	25	1.0			35	1.5
CA338-18	18	75	3.0	25	1.0			50	2.0
CA433-24	24	75	3.0	50	2.0			25	1.0
CA438-18	18	100	4.0	50	2.0			50	2.0
CB335-18	18	60	2.5	25	1.0			35	1.5
Bonding Sheets									
E-33-24	24	25	1.0					25.4	1.0

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Special Order Products

Part Number	Width (in)	Total Thickness		Polyimide Thickness		Copper Foil Thickness		Adhesive Thickness	
		μm	mil	μm	mil	μm	oz	μm	mil
Single Sided Flexible Copper Laminates									
RAR34S58-18	18	105	4.1	25	1.0	70	2.0	10	0.4
RAR44S58-18	18	131	5.1	50	2.0	70	2.0	10	0.4
Double Sided Flexible Copper Laminates									
RBM32D47-18	18	84	3.3	25	1.0	17.5	0.5	12	0.5
Coverlay Material									
CA433-18	18	75	3.0	50	2.0			25	1.0

Shin-Etsu MicroSi

Shin-Etsu MicroSi, Inc. is a wholly owned subsidiary of Shin-Etsu Chemical Co., Ltd., a global leader in research, development and the manufacture of chemicals used in the semiconductor industry. From its headquarters in Phoenix, Arizona, Shin-Etsu MicroSi provides high performance products and materials including:

- Thermal Interface Materials
- KJR Liquid Coating Materials
- Contrast Enhancement Materials
- Mask Blanks
- PBN Crucibles
- Photoresists / Developers
- Quartz Substrates & Wafers
- Liquid Underfill Materials
- Barrier Coat
- Pellicles
- Flexible Copper Laminate
- Epoxy Molding Compounds
- Adhesion Promoters

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