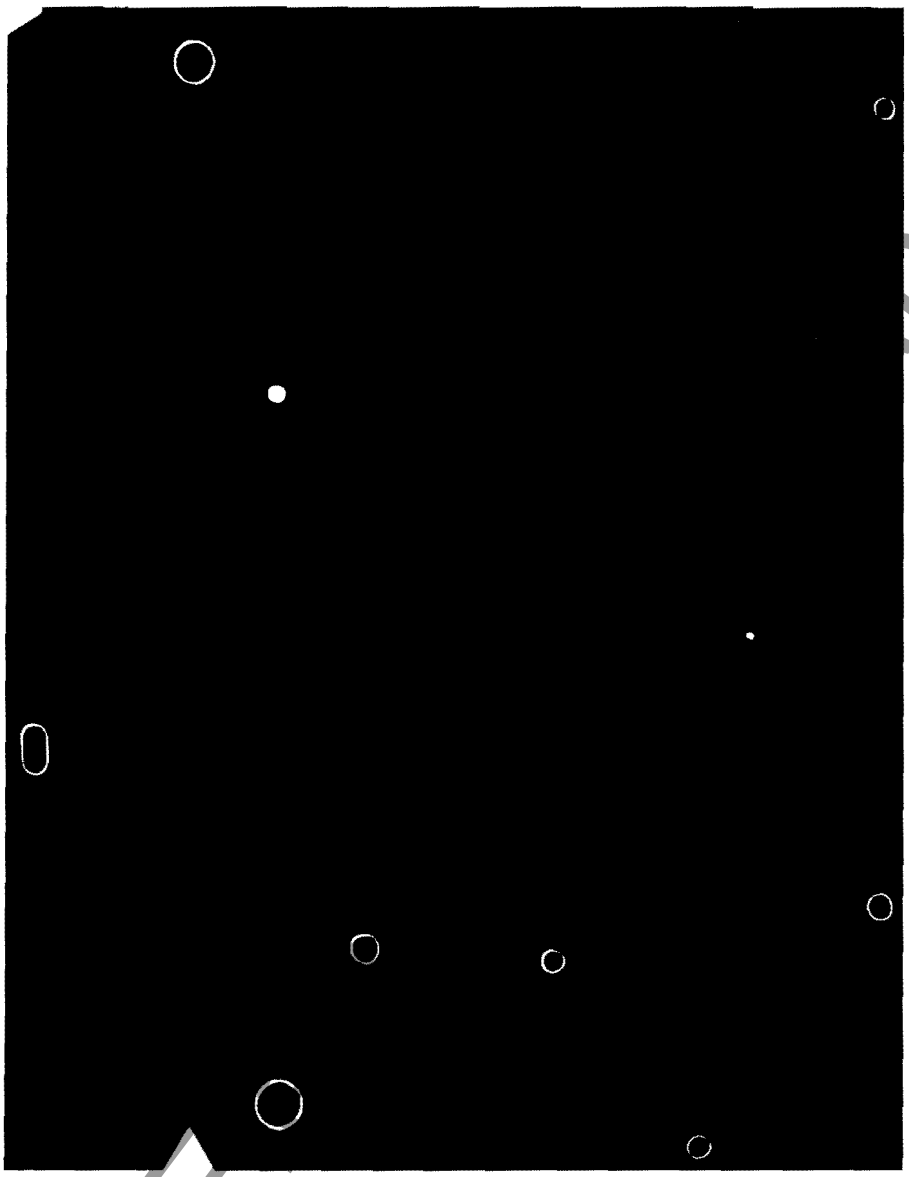
Westinghouse

Micarta® Copper-Clad Materials



Description

The Industrial Plastics Division of Westinghouse offers a comprehensive line of copper-clad Micarta for printed-circuit manufacture. There are two types of products:

1. Rigid copper-clad laminate sheet for conventional printed circuits
2. Thin, rigid copper-clad sheet and prepreg sheets specifically for building multilayer printed circuits

This Micarta line offers a broad range of properties, and combinations of properties to fill many kinds of production and end-use requirements.

Measle Resistance – 65M27, 65M28 and multi-layer are measle resistant even after storage under humid conditions. These materials also have greater retention of flex and copper bond strength at elevated temperatures.

Punchability – The strength and resiliency of Micarta, combined with the adhesive strength and malleability of the pure-copper foil, make Westinghouse copper-clad materials easy to punch, saw or drill without their peeling, tearing, lifting, or haloing.

High Bond Strength – Westinghouse copper-clad materials resist pad lifting during circuit fabrication and assembly or during final product use.

High Solder Resistance – Printed circuits of Westinghouse Micarta copper-clad materials can be solder floated without blistering or distortion, so that soldering operations can be more efficient.

Stability– Micarta materials resist heat, cold, moisture, acids, alkalies, solvents, and oils.

Grade Selection Table

Grade Number	NEMA Grade	Military Spec. Type and Number	Composition	Color	Major Application Requirements
65M02	XXXPC		Paper-Phenolic	Dark Brown	Warp-free; high impact strength, adhesion, insulation resistance.
65M03	XXXPC		Paper-Phenolic	Tan or Black	Exceptional stability; insulation resistance exceeding NEMA standards; good shearing and punching characteristics.
65M05	FR-2		Paper-Phenolic	Tan	High insulation resistance, flame retardant, cold punching.
65M24	FR-3		Paper-Epoxy	Ivory	Excellent dimensional stability; high mechanical strength; high peel and dielectric strength; self-extinguishing; low water absorption.
65M25	FR-4	Mil-P-13949-GF	Glass-Epoxy	Tan	High solder resistance without close temperature control; self-extinguishing; good punching of small holes at room temp.
65M27	G-10	Mil-P-13949-GE	Glass-Epoxy	Green	High strength at room temperature; excellent electrical properties under humid conditions; measle resistant.
65M28	FR-4	Mil-P-13949-GF	Glass-Epoxy	Green	High strength at room temperature; humidity resistant, flame retardant; measle resistant.
65M30			Glass-Epoxy	Light Green	High solder resistance under humid conditions; close thickness control for capacitance tolerance between layers of circuitry.
HT-10555			Glass-Epoxy	Light Green	

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Typical Uses of Micarta Copper-Clad Materials

Grade Number	Thickness Range, Inches	Standard② Sheet Size, Inches	Typical Use
65M02	.031-.250	③	TV and similar circuits produced by automatic processes that require very flat, strong boards
65M03	.031-.250	③	Radio and TV Circuits
65M05	.062-.250	③	Computer circuits where weight and space savings are important; electronic circuits that must support heavy components on a small area
65M25	.031-.250	③	
65M24	.031-.250	③	Commercial computer cards
65M27	.031-.250	③	Computer circuits
65M28	.031-.250	③	Computer circuits
65M30	.004-.031④	36 x 36, 36 x 43	Multi-layer miniaturized circuits
HT-10555	.004⑤	③	Multi-layer miniaturized circuits

② Other sheet sizes available on special order.
③ 36 x 36, 36 x 43 and 36 x 48 inches.
④ Base laminate thickness only. Available in both G-10 and FR-4.
⑤ Molds to this thickness per layer.

Mechanical and Electrical Properties

Property	Test Method	Grades 65M02	65M03	65M05	65M24	65M25	65M27	65M28
Peel strength, after solder float (lb per in. of width) 1-oz copper	NEMA-LI-1-10.12	8	8	8	10	10	10	10
2-oz copper		9	9	9	12	12	12	12
Solder float, sec at 500°F	NEMA-LI-1-10.11	15	15	25	20	90	90	90
Flexural strength, flatwise, LW, psi (ultimate)	ASTM D229	25,000	22,000	20,000	30,000	76,000	75,000	70,000
Impact, Izod, edgewise, LW, E-48/50 – ft-lb/in (notch)	ASTM D229	0.55	0.45	.....	0.60	10.0	10.0	10.0
Tensile strength, LW, psi (ultimate)	ASTM D229	14,500	14,000	.....	18,000	.....	.....	.....
Compressive strength, flatwise, psi (ultimate)	ASTM D229	28,000	25,000	.....	31,000	.....	.....	.....
Water absorption (%) E-1/105, D_1-24-23	ASTM D229	0.50	0.50	0.43	0.35	0.15	0.08	0.08
Hardness, Rockwell "M"	ASTM D229	105	100	....	105	115	115	115
Dissipation factor (1 megacycle) C-24/23/50	ASTM D229	.029	.032	....	.034	.018	.019	.018
D-24/23		.020	.033	0.5	.035	.020	.020	.020
D-48/50		.035	.040	....	.035	....	....	....
Dielectric constant (1 megacycle) C-24/23/50	ASTM D229	4.0	4.1	....	4.2	5.0	5.0	5.0
D-24/23		4.0	4.2	4.6	4.3	5.0	5.0	5.0
D-48/50		4.7	4.8	....	4.5	....	....	....
Dielectric breakdown, flashover values, kv, parallel to laminations, step by step, taper pins, T @ 23°C in oil C-24/23/50	ASTM D229	85	85	....	60	70	>60	>60
D-48/50		50	50	>60	60	70	>60	>60
Insulation resistance (megohms, fig. 3-257, C-96/35/90)	ASTM D299	$5x10^5$	$4x10^5$	....	$1x10^8$	$1x10^8$	$1x10^8$	$1x10^8$
Volume resistivity, (megohm-cm, C-T-96/35/90)	ASTM D229	$7x10^6$	$8x10^5$	$1.95x10^8$	$5x10^7$	$3x10^7$	$5x10^7$	$5x10^7$
Surface resistance (megohms, C-T-96/35/90)	ASTM D229	$7x10^4$	$7x10^4$	$6.6x10^4$	$3x10^4$	$3x10^4$	$1x10^6$	$1x10^6$
Arc resistance, sec	ASTM D495	..	..	..	100	100	125	125
Flammability, sec	ASTM D229, Method 1	..	..	1	5	2	..	6

Note: All data is based on 1/16-inch specimens. All specimens were conditioned in standard laboratory atmosphere, unless otherwise indicated. These are typical values. Only NEMA or specified Mil. Spec. property values are guaranteed.

Note: To minimize warpage material should be stored flat, not on edge.

Copper-clad Materials for Multilayer Circuits

Property	Test Method	Condition	Thickness of Base Laminate (Inches)	Average Test Values⑥
Grade 65M30 Copper-Clad (Also available in FR-4)				
Peel strength, after solder float (lb per in. of width) 1-oz copper	NEMA LI-1-10.12	10 sec at 500 F	.008	8.0
2-oz copper		test at 23 C		10.0
Solder float, sec at 500°F	NEMA LI-1-10.11		.008	60
Water absorption (%)	ASTM D229	E-1/105, D-24/23	.008	.4
Dielectric breakdown, flashover values, kv parallel to laminations, step by step, taper pins, T @ 23°C in oil	ASTM D229	C-24/23/50	.008	40
Dielectric constant (1 megacycle)	ASTM D229	D-24/23	.008	5.4
Dissipation factor (1 megacycle)	ASTM D229	D-24/23	.008	.028
Volume resistivity (megohm-cm)	ASTM D229	C-96/35-90	.008	1.5×10^7
Surface resistance (megohms)	ASTM D229	C-96/35/90	.008	3×10^8
Grade HT-10555 Prepreg Binder Sheet – G-10				
Resin content (%)	SPI Prepreg 1			55
Flow (%)	SPI Prepreg 2	200 psi, 300 F		35
Gel Time (minutes)	SPI Prepreg 3	300 F		4.0
Volatile content (%)	SPI Prepreg 1	250 F, 10 minutes		1.0

⑥ These are average test values and should be representative of materials supplied, but are not a guarantee of these properties, and no warranty should be construed.

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