

PTFE/Nonwoven Fiberglass Laminates: Microwave Printed Circuit Board Substrates

IsoClad[®] laminates are nonwoven fiberglass/PTFE composites for use as printed circuit board substrates. The nonwoven reinforcement allows these laminates to be used more easily in applications where the final circuit will be bent to shape. Conformal or “wrap-around” antennas are a good example.

IsoClad products use longer random fibers and a proprietary process to provide greater dimensional stability and better dielectric constant uniformity than competitive nonwoven fiberglass/PTFE laminates of similar dielectric constants.

IsoClad 917 ($\epsilon_r=2.17, 2.20$) uses a low ratio of fiberglass/PTFE to achieve the lowest dielectric constant and dissipation factor available in a combination of PTFE and fiberglass.

IsoClad 933 ($\epsilon_r=2.33$) uses a higher fiberglass/PTFE ratio for a more highly reinforced combination which offers better dimensional stability and increased mechanical strength.

Availability:

IsoClad laminates are supplied with 1/2, 1 or 2 ounce electrodeposited copper on both sides. Other copper weights and rolled copper foil are available. IsoClad is available bonded to a heavy metal ground plane. Aluminum, brass or copper plates also provide an integral heat sink and mechanical support to the substrate.

When ordering IsoClad products, please specify dielectric constant, thickness, cladding, panel size and any other special considerations. Available master sheet sizes include 36" x 48" and 36" x 72".

Typical Properties: IsoClad® PTFE/Nonwoven Fiberglass Laminates

Properties	Test Method	Condition	Typical Values IsoClad 917	Typical Values IsoClad 933
Dielectric Constant @10GHz	IPC TM-650 2.5.5.5	C23/50	2.17, 2.20	2.33
Dissipation Factor @10GHz	IPC TM-650 2.5.5.5	C23/50	0.0013	0.0016
Thermal Coefficient of ϵ_r (ppm/°C)	IPC TM-650 2.5.5.5 Adapted	-10°C to +140°C	-157	-132
Peel Strength (lbs per inch)	IPC TM-650 2.4.8	After Thermal Stress	10	10
Volume Resistivity (M Ω -cm)	IPC TM-650 2.5.17.1	C96/35/90	1.5 x 10 ¹⁰	3.5 x 10 ⁸
Surface Resistivity (M Ω)	IPC TM-650 2.5.17.1	C96/35/90	1.0 x 10 ⁹	1.0 x 10 ⁸
Arc Resistance (seconds)	ASTM D-495	D48/50	> 180	> 180
Tensile Modulus (kpsi)	ASTM D-638	A, 23°C	133, 120	173, 147
Tensile Strength (kpsi)	ASTM D-882	A, 23°C	4.3, 3.8	6.8, 5.3
Compressive Modulus (kpsi)	ASTM D-695	A, 23°C	182	197
Flexural Modulus (kpsi)	ASTM D-790	A, 23°C	213	239
Dielectric Breakdown (kv)	ASTM D-149	D48/50	> 45	> 45
Specific Gravity (g/cm ³)	ASTM D-792 Method A	A, 23°C	2.23	2.27
Water Absorption (%)	MIL-S-13949H 3.7.7 IPC TM-650 2.6.2.2	E1/105 + D24/23	0.04	0.05
Coefficient of Thermal Expansion (ppm/°C)	IPC TM-650 2.4.24 Mettler 3000 Thermomechanical Analyzer	0°C to 100°C		
X Axis			46	31
Y Axis			47	35
Z Axis			236	203
Thermal Conductivity (W/mK)	ASTM E-1225	100°C	0.263	0.263
Outgassing	NASA SP-R-0022A			
Total Mass Loss (%)	Maximum 1.00%	125°C, $\leq 10^{-6}$ torr	0.02	0.03
Collected Volatile	Maximum 0.10%		0.00	0.00
Condensable Material (%)				
Water Vapor Regain (%)			0.02	0.02
Visible Condensate (\pm)			NO	NO
Flammability	UL 94 Vertical Burn IPC TM-650 2.3.10	C48/23/50, E24/125	Meets requirements of UL94V-0	Meets requirements of UL94V-0

Data based on 0.062" dielectric thickness, exclusive of metal cladding except where indicated by test method. Results listed above are typical properties; they are not to be used as specification limits. The above information creates no expressed or implied warranties. The properties of IsoClad laminates may vary depending on the application.

The information and data contained herein are believed reliable, but all recommendations or suggestions are made without guarantee. You should thoroughly and independently test materials for any planned applications and determine satisfactory performance before commercialization. Furthermore, no suggestion for use, or material supplied shall be construed as a recommendation or inducement to violate any law or infringe any patent.

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