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# TECHNICAL DATA SHEET

## PTFE BOARDS

(Item Code ABT ...)



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## PTFE/Woven Fiberglass Laminates: Microwave Printed Circuit Board Substrates

CIF laminates are woven fiberglass/PTFE composite materials for use as printed circuit board substrates. Using precise control of the fiberglass/PTFE ratio, CIF laminates offer a range of choices from the lowest dielectric constant and dissipation factor to a more highly reinforced laminate with better dimensional stability.

The woven fiberglass reinforcement in CIF products provides greater dimensional stability than nonwoven fiberglass reinforced PTFE based laminates of similar dielectric constants. The consistency and control of the PTFE coated fiberglass cloth allows CIF to offer a greater variety of dielectric constants and produces a laminate with better dielectric constant uniformity than comparable nonwoven fiberglass reinforced laminates. The coated fiberglass plies in CIF materials are aligned in the same direction.

Crossplied versions of many of these materials are available as CIF materials.

CIF laminates are frequently used in filter, coupler and low noise amplifier applications, where dielectric constant uniformity is critical. They are also used in power dividers and combiners where low loss is important.

**CIF ABT...** ( $\epsilon_r=2.40 - 2.65$ ) use a higher fiberglass/PTFE ratio to provide mechanical properties approaching conventional substrates. Other advantages include better dimensional stability and lower thermal expansion in all directions. The electrical properties of ABT... is tested at 1MHz and 10GHz respectively.

### Availability:

CIF laminates are supplied with 1/2, 1 or 2 ounce electrodeposited copper on both sides. Other copper weights and rolled copper foil are available. DiClad 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 CIF products please specify dielectric constant, thickness, cladding, panel size and any other special considerations. Available master sheet sizes include 36" x 48", 36" x 72" and 48" x 54".

## Typical Properties: PTFE/Woven Fiberglass Laminates

Properties	Test Method	Condition	Typical Values	Typical Values	Typical Values
Dielectric Constant @10GHz	IPC TM-650 2.5.5.5	C23/50	2.17, 2.20	2.33	2.40 to 2.65
Dielectric Constant @1MHz	IPC TM-650 2.5.5.3	C23/50	2.17, 2.20	2.33	2.40 to 2.65
Dissipation Factor @10GHz	IPC TM-650 2.5.5.5	C23/50	0.0009	0.0013	0.0022
Dissipation Factor @1MHz	IPC TM-650 2.5.5.3	C23/50	0.0008	0.0009	0.0010
Thermal Coefficient of $E_f$ (ppm/°C)	IPC TM-650 2.5.5.5 Adapted	-10°C to +140°C	-160	-161	-153
Volume Resistivity (M $\Omega$ -cm)	IPC TM-650 2.5.17.1	C96/35/90	$1.4 \times 10^9$	$1.5 \times 10^9$	$1.2 \times 10^9$
Surface Resistivity (M $\Omega$ )	IPC TM-650 2.5.17.1	C96/35/90	$2.9 \times 10^6$	$3.4 \times 10^7$	$4.5 \times 10^7$
Arc Resistance (seconds)	ASTM D-495	D48/50	> 180	> 180	> 180
Tensile Modulus (kpsi)	ASTM D-638	A, 23°C	267, 202	485, 346	706, 517
Tensile Strength (kpsi)	ASTM D-882	A, 23°C	8.1, 7.5	14.9, 11.2	19.0, 15.0
Compressive Modulus (kpsi)	ASTM D-695	A, 23°C	237	327	359
Flexural Modulus (kpsi)	ASTM D-790	A, 23°C	357	437	537
Dielectric Breakdown (kv)	ASTM D-149	D48/50	> 45	> 45	> 45
Specific Gravity (g/cm <sup>3</sup> )	ASTM D-792 Method A	A, 23°C	2.23	2.26	2.31
Water Absorption (%)	MIL-S-13949H 3.7.7 IPC TM-650 2.6.2.2	E1/105 + D24/23	0.02	0.02	0.03
Coefficient of Thermal Expansion (ppm/°C) X Axis Y Axis Z Axis	IPC TM-650 2.4.24 Mettler 3000 Thermomechanical Analyzer	0°C to 100°C	25 34 252	17 29 217	14 21 173
Thermal Conductivity (W/mK)	ASTM E-1225	100°C	0.261	0.257	0.254
Outgassing Total Mass Loss (%) Collected Volatile Condensable Material (%) Water Vapor Regain (%) Visible Condensate ( $\pm$ )	NASA SP-R-0022A Maximum 1.00% Maximum 0.10%	125°C, $\leq 10^{-6}$ torr	0.01 0.01 0.01 NO	0.02 0.00 0.01 NO	0.02 0.00 0.01 NO
Flammability UL File E 80166	UL 94 Vertical Burn IPC TM-650 2.3.10	C48/23/50, E24/125	UL94V-0	UL94V-0	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 CIF laminates may vary depending on the application.

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