

PTFE/Nonwoven Fiberglass/Ceramic Laminates: Circuit Board Substrates for High Speed and Microwave Applications

AR350[®] and AR450[®] represent a class of PTFE based laminates designed to offer dielectric constants similar to thermoset laminates. These materials offer nominal dielectric constants of 3.50 and 4.50, approximating the values of such resin systems as BT, cyanate ester and FR-4 epoxy. Since the dielectric constants match the existing thermoset materials, designs on these products would not require modification to take advantage of the lower loss properties available with the AR350 and AR450 products.

The nominal dielectric constant tolerance of ± 0.03 is more consistent than that of typical thermoset grades, assuring more consistent performance. Another significant advantage offered by these products includes the loss tangent performance a designer would expect with PTFE based laminates, up to an order of magnitude better than thermoset resin based materials.

Adapting coating technology from PTFE/glass laminates, AR350 and AR450 have much better dielectric constant uniformity, both within a sheet and between sheets, than thermoset based laminates of similar dielectric constants. To the designer, dielectric constant uniformity and low loss tangent allow better impedance control and a higher signal to noise ratio.

Availability:

AR350 and AR450 laminates are supplied with 1/2, 1 or 2 ounce electrodeposited copper on both sides. Other copper weights and rolled copper foil are available. AR350 and AR450 are 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 AR350 and AR450 products, please specify thickness, cladding, panel size and any other special considerations. Available master sheet sizes include 36" x 48" and 36" x 72".

Typical Properties: AR350[®] and AR450[®] PTFE/Nonwoven Fiberglass/Ceramic Laminates

Properties	Test Method	Condition	Typical Values AR350	Typical Values AR450
Dielectric Constant @10GHz	IPC TM-650 2.5.5.5	C23/50	3.50	4.50
Dissipation Factor @10GHz	IPC TM-650 2.5.5.5	C23/50	0.0026	0.0026
Thermal Coefficient of E _r (ppm/ °C)	IPC TM-650 2.5.5.5 Adapted	-10 °C to +140 °C	-213	-238
Volume Resistivity (MΩ-cm)	IPC TM-650 2.5.17.1	C96/35/90	3.4 x 10 ¹³	3.3 x 10 ¹³
Surface Resistivity (MΩ)	IPC TM-650 2.5.17.1	C96/35/90	4.6 x 10 ¹¹	4.8 x 10 ¹¹
Arc Resistance (seconds)	ASTM D-495	D48/50	> 180	> 180
Tensile Modulus (kpsi)	ASTM D-638	A, 23 °C	154	155
Tensile Strength (kpsi)	ASTM D-882	A, 23 °C	147	150
Compressive Modulus (kpsi)	ASTM D-695	A, 23 °C	223	228
Flexural Modulus (kpsi)	ASTM D-790	A, 23 °C	342	345
Dielectric Breakdown (kv)	ASTM D-149	D48/50	> 45	> 45
Specific Gravity (g/cm ³)	ASTM D-792 Method A	A, 23 °C	2.36	2.39
Water Absorption (%)	MIL-S-13949H 3.7.7 IPC TM-650 2.6.2.2	E1/105 + D24/23	0.08	0.08
Coefficient of Thermal Expansion (ppm/ °C)	IPC TM-650 2.4.24 Mettler 3000 Thermomechanical Analyzer	0 °C to 100 °C		
X Axis			35	30
Y Axis			35	30
Z Axis			115	110
Thermal Conductivity (W/mK)	ASTM E-1225	100 °C	0.310	0.320
Outgassing	NASA SP-R-0022A			
Total Mass Loss (%)	Maximum 1.00%	125 °C, ≤ 10 ⁻⁶ torr	0.04	0.04
Collected Volatile Condensable Material (%)	Maximum 0.10%		0.01	0.01
Water Vapor Recovered (%)			0.03	0.03
Visible Condensate (±)			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 AR350 and AR450 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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