

### **PTFE/Nonwoven Fiberglass/Ceramic Filled Laminates High Speed and Microwave Printed Circuit Boards**

AR350™ and AR450™ are nonwoven fiberglass reinforced, ceramic-filled, PTFE based laminates for use as printed circuit substrates. They are designed with nominal dielectric constants of 3.5 and 4.5, respectively. These values approximately match those of BT/Cyanate Ester and FR-4 epoxy systems on woven fiberglass. As a result, designs on these conventional products could be readily translated to lower loss AR350 and AR450 (roughly an order of magnitude lower) without significant changes.

To the designer, the dielectric constant uniformity of AR350 and AR450 allows better phase consistency and impedance control; with lower loss as well, higher signal to noise ratio is also realized.

#### **Applications:**

Typical applications for AR350 and AR450 include LNB's, Commercial Antennas, Power Amplifiers and other products for telecommunications infrastructure.

#### **Availability:**

AR350 and AR450 laminates can be supplied with 1/2, 1 or 2 ounce electrodeposited copper on both sides. Other copper foil types and weights may be available, and these materials can also be supplied with heavy metal ground planes. Aluminum, brass or copper plate provides integral heat-sink capacity as well as mechanical support for the substrate materials.

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	0.0035
Thermal Coefficient of E <sub>r</sub> (ppm/°C)	IPC TM-650 2.5.5.5 Adapted	-10°C to +140°C	-213	-238
Peel Strength (lbs per inch)	IPC TM-650 2.4.8	After Thermal Stress	12	8
Volume Resistivity (MΩ-cm)	IPC TM-650 2.5.17.1	C96/35/90	3.4 x 10 <sup>13</sup>	3.3 x 10 <sup>13</sup>
Surface Resistivity (MΩ)	IPC TM-650 2.5.17.1	C96/35/90	4.6 x 10 <sup>11</sup>	4.8 x 10 <sup>11</sup>
Arc Resistance (seconds)	ASTM D-495	D48/50	> 180	> 180
Tensile Modulus (kpsi)	ASTM D-638	A, 23°C	154, 147	155, 150
Tensile Strength (kpsi)	ASTM D-882	A, 23°C	5.1, 3.9	2.2, 2.0
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 <sup>3</sup> )	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) X Axis Y Axis Z Axis	IPC TM-650 2.4.24 Mettler 3000 Thermomechanical Analyzer	0°C to 100°C	35 35 107	30 30 102
Thermal Conductivity (W/mK)	ASTM E-1225	100°C	0.310	0.320
Outgassing Total Mass Loss (%) Collected Volatile Condensable Material (%) Water Vapor Regain (%) Visible Condensate (±)	NASA SP-R-0022A Maximum 1.00% Maximum 0.10%	125°C, ≤ 10 <sup>-6</sup> torr	0.04 0.01 0.03 NO	- - - -
Flammability	UL 94 Vertical Burn IPC TM-650 2.3.10	C48/23/50, E24/125	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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