

### **PTFE/Woven Fiberglass Laminates: Ceramic Filled Printed Circuit Board Substrate For *High Speed* and Microwave Applications**

AD350 PTFE laminates are ceramic filled woven glass reinforced composite materials, engineered specifically to reduce cost as a printed circuit board substrate. AD350 represents a class of PTFE based laminates designed to offer a dielectric constant similar to thermoset laminates. This allows minimal modification to designs while benefiting from the exceptional reduction in loss (Df) characteristics.

AD350's consistent nominal dielectric constant (Dk) tolerance of  $\pm .12$  is superior to those of thermoset grades, assuring consistent performance. PTFE based laminates offer superior loss tangent performance as well, up to an order of magnitude over thermoset based materials. To the designer, dielectric constant uniformity and low loss tangent allow improved impedance control and higher signal to noise ratio.

AD350 combines excellent low loss electrical properties with enhanced value woven fiberglass to provide low cost rigid laminate material specifically designed for today's volume commercial wireless applications. The higher weight ratio of fiberglass to PTFE resin yields laminates with greater dimensional stability than is normally expected of PTFE-based substrates. Woven 7628 glass reinforcement increases displacement of PTFE resin significantly. This affords "PTFE performance" at an economical cost.

AD350 laminate materials utilize processing steps consistent with those of standard PTFE printed circuit processing recommendations. Due to the relatively high percentage of reinforced fiberglass and ceramic characteristics, thermal expansion, (CTE), is reduced in all directions, improving plated-thru-hole reliability.

AD350 has excellent Peel Strength for half and one ounce copper which is critical in hand assembly and/or rework.

#### **Availability:**

AD350 materials are supplied with 1/2 ounce, 1 ounce, or 2 ounce electrodeposited copper foil on both sides. Material is also available bonded to a heavy metal ground plane. Aluminum, brass and copper plate may be specified, providing an integral heat sink and mechanical support. When ordering please specify dielectric thickness, choice of cladding, panel size and any other special considerations. Panels are available to 36x72.

## Typical Properties: AD350

Properties	Test Method	Condition	Typical Values
Dielectric Constant	IPC TM-650 2.5.5.5	C23/50	3.5 ± .12
Dissipation Factor	IPC TM-650 2.5.5.5	C23/50	0.003
Thermal Coefficient of Dielectric Constant	IPC TM-650 2.5.5.5 Adapted	-10°C to 140°C	-110 ppm/C
Peel Strength (lbs per inch)	IPC TM-650 2.4.8	After Thermal Stress	1
Peel Strength half ounce	IPC TM-650 2.4.8	n/a	15 lbs
Peel Strength one ounce	IPC TM-650 2.4.8	n/a	17 lbs
Volume Resistivity	IPC TM-650 2.5.17.1	C96/35/90	1.2 x 10 <sup>(9)</sup> megohm-cm
Surface Resistivity	IPC TM-650 2.5.17.1	C96/35/90	4.5 x 10 <sup>(7)</sup> megohm-cm
Arc Resistance	ASTM D-495	D48/50	> 180 seconds
Tensile Modulus	ASTM D-638	A, 23°C	706 kpsi
Tensile Strength	ASTM D-882	A, 23°C	517 kpsi
Compressive Modulus	ASTM D-695	A, 23°C	365 kpsi
Flexural Modulus	ASTM D-790	A, 23°C	540 kpsi
Dielectric Strength	ASTM D-149	D48/50	> 45 kv
Specific Gravity	ASTM D-792A	A, 23°C	2.4 g/cm(3)
Water Absorption	IPC TM-650 2.6.2.2	E1/105, D24/23	0.06%
Coefficient of Thermal Expansion (CTE) X Axis Y Axis Z Axis		0°C to 100°C	12/ppm/C 15/ppm/C 95/ppm/C
Thermal Conductivity	ASTM E-1225	100°C	0.235 W/mK
Flammability	UL 94	C48/23/50, E24/125	94 V-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 AD350 laminates may vary depending on the application, and should be thoroughly tested prior to commercialization.*

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