PTFE/Nonwoven Fiberglass Laminates

Features:
- Nonwoven Fiberglass Reinforcement
- Low Dielectric Constant
- Extremely Low Loss

Benefits:
- Less Rigid than Woven Fiberglass
- Highly Isotropic in X,Y and Z Directions

Typical Applications:
- Conformal Antennas
- Stripline and Microstrip Circuits
- Missile Guidance Systems
- Radar and Electronic Warfare Systems

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 (Er=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 (Er=2.33) uses a higher fiberglass/PTFE ratio for a more highly reinforced combination that offers better dimensional stability and increased mechanical strength.
### Typical Properties: IsoClad

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Condition</th>
<th>IsoClad 917</th>
<th>IsoClad 933</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric Constant @ 10GHz</td>
<td>IPC TM-650 2.5.5.5</td>
<td>C23/50</td>
<td>2.17, 2.20</td>
<td>2.33</td>
</tr>
<tr>
<td>Dissipation Factor @ 10 GHz</td>
<td>IPC TM-650 2.5.5.5</td>
<td>C23/50</td>
<td>0.0013</td>
<td>0.0016</td>
</tr>
<tr>
<td>Thermal Coefficient of Er (ppm/°C)</td>
<td>IPC TM-650 2.5.5.5</td>
<td>-10°C to +140°C</td>
<td>-157</td>
<td>-132</td>
</tr>
<tr>
<td>Peel Strength (lbs.per inch)</td>
<td>IPC TM-650 2.4.8</td>
<td>After Thermal</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Volume Resistivity (MΩ-cm)</td>
<td>IPC TM-650 2.5.17.1</td>
<td>C96/35/90</td>
<td>1.5 x 10\textsuperscript{10}</td>
<td>3.5 x 10\textsuperscript{8}</td>
</tr>
<tr>
<td>Surface Resistivity (MΩ)</td>
<td>IPC TM-650 2.5.17.1</td>
<td>C96/35/90</td>
<td>1.0 x 10\textsuperscript{9}</td>
<td>1.0 x 10\textsuperscript{8}</td>
</tr>
<tr>
<td>Arc Resistance (seconds)</td>
<td>ASTM D-495</td>
<td>D48/50</td>
<td>&gt;180</td>
<td>&gt;180</td>
</tr>
<tr>
<td>Tensile Modulus (kpsi)</td>
<td>ASTM D-638</td>
<td>A, 23°C</td>
<td>133, 120</td>
<td>173, 147</td>
</tr>
<tr>
<td>Tensile Strength (kpsi)</td>
<td>ASTM D-882</td>
<td>A, 23°C</td>
<td>4.3, 3.8</td>
<td>6.8, 5.3</td>
</tr>
<tr>
<td>Compressive Modulus (kpsi)</td>
<td>ASTM D-695</td>
<td>A, 23°C</td>
<td>182</td>
<td>197</td>
</tr>
<tr>
<td>Flexural Modulus (kpsi)</td>
<td>ASTM D-790</td>
<td>A, 23°C</td>
<td>213</td>
<td>239</td>
</tr>
<tr>
<td>Dielectric Breakdown (kv)</td>
<td>ASTM D-149</td>
<td>D48/50</td>
<td>&gt;45</td>
<td>&gt;45</td>
</tr>
<tr>
<td>Density (g/cm\textsuperscript{3})</td>
<td>ASTM D-792 Method A</td>
<td>A, 23°C</td>
<td>2.23</td>
<td>2.27</td>
</tr>
<tr>
<td>Water Absorption (%)</td>
<td>MIL-S-13949H 3.7.7</td>
<td>E1/105 + D24/23</td>
<td>0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>Coefficient of Thermal Expansion (ppm/°C)</td>
<td>IPC TM-650 2.4.24</td>
<td>0°C to 100°C</td>
<td>46</td>
<td>31</td>
</tr>
<tr>
<td>X Axis</td>
<td>Mettler 3000 Thermomechanical Analyzer</td>
<td></td>
<td>47</td>
<td>35</td>
</tr>
<tr>
<td>Y Axis</td>
<td></td>
<td></td>
<td>236</td>
<td>203</td>
</tr>
<tr>
<td>Z Axis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal Conductivity (W/mK)</td>
<td>ASTM E-1225</td>
<td>100°C</td>
<td>0.263</td>
<td>0.263</td>
</tr>
<tr>
<td>Outgassing</td>
<td>Maximum 1.00%</td>
<td>125°C, ≤10\textsuperscript{-6} torr</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Total Mass Loss (%)</td>
<td>Maximum 0.10%</td>
<td></td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Collected Volatile Condensable Material (%)</td>
<td></td>
<td></td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Water Vapor Regain (%)</td>
<td></td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Visible Condensate (±)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammability</td>
<td>UL 94 Vertical Burn</td>
<td>C48/23/50, E24/125</td>
<td>Meets require-ments of UL94-V0</td>
<td>Meets require-ments of UL94-V0</td>
</tr>
</tbody>
</table>

**Material 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”.

*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 Arlon laminates may vary, depending on the design and application.*
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 Arlon laminates may vary, depending on the design and application.

**Figure 1**
Demonstrates the Stability of Dielectric Constant across Frequency. This information was correlated from data generated by using a free space and circular resonator cavity. This characteristic demonstrates the inherent robustness of Arlon Laminates across Frequency, thus simplifying the final design process when working across EM spectrum. The stability of the Dielectric Constant of IsoClad over frequency insures easy design transition and scalability of design.

**Figure 2**
Demonstrates the Stability of Dissipation Factor across Frequency. This characteristic demonstrates the inherent robustness of Arlon Laminates across Frequency, providing a stable platform for high frequency applications where signal integrity is critical to the overall performance of the application.
MATERIALS FOR ELECTRONICS

CONTACT INFORMATION:

For samples, technical assistance, customer service or for more information, please contact Arlon Materials for Electronics Division at the following locations:

**NORTH AMERICA:**
Arlon LLC
Electronic Substrates
9433 Hyssop Drive
Rancho Cucamonga, CA 91730
Tel: (909) 987-9533
Fax: (909) 987-8541

Arlon LLC
Microwave Materials
1100 Governor Lea Road
Bear, DE 19701
Tel: (800) 635-9333
Outside U.S. & Canada: (302) 834-2100
Fax: (302) 834-2574

**SOUTHERN CHINA:**
Arlon LLC
Room 805, Unit 3, Bldg 4
Liyuan, Xincun Holiday Road
Huaqiao Cheng, Shenzhen 518053
China
Tel/Fax: (86) 755-269-066-12

**NORTHERN CHINA:**
Arlon LLC
Room 11/401, No. 8
Hong Gu Road
Shanghai, China 200336
Tel/Fax: (86) 21-6209-0202

**EUROPE:**
Arlon LLC
44 Wilby Avenue
Little Lever
Bolton, Lancasters BL31QE
United Kingdom
Tel: (44) 120-457-6068
Fax: (44) 120-479-6463

© 2008, 2009 Arlon LLC

Or visit us on the web at:
www.arlon-med.com

Certified to
ISO 9001:2008