PTFE/Woven Fiberglass Laminates
Microwave Printed Circuit Board Substrates

Features:
• Cross-Plied Woven Fiberglass, alternating plies are oriented 90° to each other
• High PTFE to Glass Ratio
• Better dielectric constant uniformity than comparable non-woven fiberglass reinforced laminates

Benefits:
• Electrical and Mechanical Isotropy in the X-Y Plane
• Extremely Low Loss
• Well Suited for Er Sensitive Circuits

Typical Applications:
• Military Electronics (Radars, ECM, ESM)
• Microwave Components (LNAs, filters, couplers, etc.)

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

The woven fiberglass reinforcement in CuClad products provides greater dimensional stability than non-woven fiberglass reinforced PTFE based laminates of similar dielectric constants. The consistency and control of the PTFE coated fiberglass cloth allows Arlon to offer a greater variety of dielectric constants and produces a laminate with better dielectric constant uniformity than comparable non-woven fiberglass reinforced laminates. These properties make CuClad an attractive choice for filters, couplers and low noise amplifiers.

CuClad laminates are cross-plied (alternating layers of coated fiberglass plies are oriented 90° to each other). This provides true electrical and mechanical isotropy in the XY plane, a feature unique to CuClad. No other woven or nonwoven fiberglass reinforced PTFE based laminates make this claim. Designers have found this degree of isotropy critical in some phased array antenna applications.

CuClad 217 (Er=2.17, 2.20) uses a low fiberglass/PTFE ratio to provide the lowest dielectric constant and dissipation factor available in fiberglass reinforced PTFE based laminates. Together, these properties offer faster signal propagation and higher signal/noise ratios.

CuClad 233 (Er=2.33) uses a medium fiberglass/PTFE ratio to balance lower dielectric constant and improved dissipation factor without sacrificing mechanical properties.

CuClad 250 (Er=2.40–2.60) uses a higher fiberglass/PTFE ratio to provide mechanical properties approaching those of conventional substrates. Better dimensional stability and lower thermal expansion in all directions are other significant benefits. The electrical properties of CuClad 250GT and CuClad 250GX are tested at 1 MHz and 10 GHz respectively. For critical performance applications, CuClad products may be specified with an “LX” testing grade; this designates that each sheet will be tested individually and a test report will be issued with the order.
Material Availability:

CuClad laminates are supplied with 1/2, 1 or 2 ounce electrodeposited copper on both sides. Other copper weights and rolled copper foil are available. CuClad 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 CuClad products please specify dielectric constant, thickness, cladding, panel size and any other special considerations. Available master sheet sizes include 36” x 36” in a cross-plied configuration and 36” x 48” in a parallel plied configuration.

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Condition</th>
<th>CuClad 217</th>
<th>CuClad 233</th>
<th>CuClad 250</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>
<td>2.40 to 2.60</td>
</tr>
<tr>
<td>Dielectric Constant @ 1MHz</td>
<td>IPC TM-650 2.5.5.3</td>
<td>C23/50</td>
<td>2.17, 2.20</td>
<td>2.33</td>
<td>2.40 to 2.60</td>
</tr>
<tr>
<td>Dissipation Factor @10 GHz</td>
<td>IPC TM-650 2.5.5.5</td>
<td>C23/50</td>
<td>0.0009</td>
<td>0.0013</td>
<td>0.0022</td>
</tr>
<tr>
<td>Thermal Coefficient of Er (ppm/°C)</td>
<td>IPC TM-650 2.5.5.5</td>
<td>Adapted -10°C to +140°C</td>
<td>-151</td>
<td>-171</td>
<td>-170</td>
</tr>
<tr>
<td>Peel Strength (lbs./per inch)</td>
<td>IPC TM-650 2.4.8</td>
<td>After Thermal</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Volume Resistivity (MΩ·cm)</td>
<td>IPC TM-650 2.5.17.1</td>
<td>C96/35/90</td>
<td>2.3 x 10⁸</td>
<td>8.0 x 10⁸</td>
<td>8.0 x 10⁹</td>
</tr>
<tr>
<td>Surface Resistivity (MΩ)</td>
<td>IPC TM-650 2.5.17.1</td>
<td>C96/35/90</td>
<td>3.4 x 10⁶</td>
<td>2.4 x 10⁶</td>
<td>1.5 x 10⁶</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>
<td>&gt;180</td>
</tr>
<tr>
<td>Tensile Modulus (kpsi)</td>
<td>ASTM D-638</td>
<td>A, 23°C</td>
<td>275, 219</td>
<td>510, 414</td>
<td>725, 572</td>
</tr>
<tr>
<td>Tensile Strength (kpsi)</td>
<td>ASTM D-882</td>
<td>A, 23°C</td>
<td>8.8, 6.6</td>
<td>10.3, 9.8</td>
<td>26.0, 20.5</td>
</tr>
<tr>
<td>Compressive Modulus (kpsi)</td>
<td>ASTM D-695</td>
<td>A, 23°C</td>
<td>237</td>
<td>276</td>
<td>342</td>
</tr>
<tr>
<td>Flexural Modulus (kpsi)</td>
<td>ASTM D-790</td>
<td>A, 23°C</td>
<td>357</td>
<td>371</td>
<td>456</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>
<td>&gt; 45</td>
</tr>
<tr>
<td>Density (g/cm³)</td>
<td>ASTM D-792 Method A</td>
<td>A, 23°C</td>
<td>2.23</td>
<td>2.26</td>
<td>2.31</td>
</tr>
<tr>
<td>Water Absorption (%)</td>
<td>MIL-S-13949H 3.7.7</td>
<td>E1/105 + D24/23</td>
<td>0.02</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Coefficient of Thermal Expansion</td>
<td>IPC TM-650 2.4.24</td>
<td>Mettler 3000 Thermomechanical Analyzer</td>
<td>0°C to 100°C</td>
<td>29</td>
<td>23</td>
</tr>
<tr>
<td>X Axis</td>
<td></td>
<td></td>
<td>28</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Y Axis</td>
<td></td>
<td></td>
<td>246</td>
<td>194</td>
<td></td>
</tr>
<tr>
<td>Z Axis</td>
<td></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>0.261</td>
<td>0.258</td>
<td>0.254</td>
</tr>
<tr>
<td>Outgassing</td>
<td>NASA SP-R-0022A</td>
<td>Maximum 1.00%</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Collected Volatile Condensable Material (%)</td>
<td>Maximum 0.10%</td>
<td>0.00</td>
<td>NO</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Water Vapor Regain (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visible Condensate (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammability</td>
<td>UL 94 Vertical Burn</td>
<td>IPC TM-650 2.3.10</td>
<td>Meets requirements of UL94-V0</td>
<td>Meets requirements of UL94-V0</td>
<td>Meets requirements of UL94-V0</td>
</tr>
</tbody>
</table>

Results listed above are typical properties; they are not to be used as specification limits. The above information creates no expressed or implied warranty. The properties of Arlon laminates may vary, depending on the design and application.
CuClad 217

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 CuClad 217 over frequency ensures 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.
CuClad 250GX

Figure 3
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 CuClad 250GX over frequency insures easy design transition and scalability of design.

Figure 4
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.
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, Inc.
Electronic Substrates
9433 Hyssop Drive
Rancho Cucamonga, CA 91730
Tel: (909) 987-9533
Fax: (909) 987-8541

Arlon, Inc.
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, Inc.
Room 805, Unit 3, Bldg 4
Liyuan, Xincun Holiday Road
Huqiao Cheng, Shenzhen  518053
China
Tel/Fax: (86) 755-269-066-12

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

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

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

2005 Rev A
SUNSTAR 商斯达实业集团是集研发、生产、工程、销售、代理经销 、技术咨询、信息服务等为一体的高科技企业，是专业高科技电子产品生产厂家，是具有 10 多年历史的电子元器件供应商，是中国最早和最大的仓储式连锁规模经营大型综合电子零部件代理分销商之一，是一家专业代理和分销世界各大品牌 IC 芯片和电子元器件的连锁经营综合性国际公司，专业经营进口、国产名厂名牌电子元器件、型号、种类齐全。在香港、北京、深圳、上海、西安、成都等全国主要电子市场设有直属分公司和产品展示展销窗口门市部专卖店及代理分销商。已在全国范围内建成强大统一的供货和代理分销网络。我们专业代理经销、开发生产电子元器件、集成电路、传感器、微波光电元器件、工控机/DOC/DOM 电子盘、专用电路、单片机开发、MCU/DSP/ARM/FPGA 软件硬件、二极管、三极管、模块等，是您可靠的一站式现货配套供应商、方案提供商、部件功能模块开发配套商。商斯达实业公司拥有庞大的资料库，有数位毕业于著名高校——有中国电子工业摇篮之称的西安电子科技大学(西军电)并长期从事国防尖端科技研究的高级工程师为您精挑细选、量身订做各种高科技电子元器件，并解决各种技术问题。

微波光电部专业代理经销高频、微波、光纤、光电元器件、组件、部件、模块、整机；电磁兼容元器件、材料、设备：微波 CAD、EDA 软件、开发测试仿真工具；微波、光纤仪器仪表。

欢迎您同世界各地的电子产品的经销商和电子元器件供应商寻求合作。我们有着庞大的资料库，有数位毕业于著名高校——有中国电子工业摇篮之称的西安电子科技大学(西军电)并长期从事国防尖端科技研究的高级工程师为您精挑细选、量身订做各种高科技电子元器件，并解决各种技术问题。

更多产品请看本公司产品专用销售网站：

商斯达中国传感器科技信息网：http://www.sensor-ic.com/
商斯达工控安防网：http://www.pc-ps.net/
商斯达电子元器件网：http://www.sunstare.com/
商斯达微波光电产品网：HTTP://www.rfoe.net/
商斯达消费电子产品网：://www.icasic.com/
商斯达实业科技产品网：://www.sunstars.cn/微波元器件销售热线：

地址：深圳市福田区福华路福庆街鸿图大厦 1602 室
电话：0755-82884100 83397033 83396822 83398585
传真：0755-83376182 （0）13823648918 MSN：SUNS8888@hotmail.com
邮编：518033 E-mail：szss20@163.com QQ：195847376

欢迎索取免费详细资料、设计指南和光盘。产品凡多，未能尽录，欢迎来电查询。

北京分公司：北京市海淀区春晖路鸿图大厦 1602 室
TEL: 010-81159046 82615020 13501189838 FAX: 010-62543996
上海分公司：上海市北京东路 668 号上海赛格电子市场 D125 号
TEL: 021-28311762 56703037 13701955389 FAX: 021-56703037
西安分公司：西安高新开发区 20 号(中国电子科技集团导航技术研究所)
西安劳动南路 88 号电子商城二楼 D23 号
TEL: 029-81022619 13072977981 FAX: 029-88789382