

### **Reduced Passive Intermodulation (PIM) Laminate Series**

Arlon's reduced Passive Intermodulation (PIM) laminates are a series of woven fiberglass reinforced Teflon (PTFE) composite materials designed for use as printed circuit laminates. They have been engineered to reduce the contribution of the base laminate to Passive Intermodulation loss and distortion in finished microwave constructions, for example, antennas and filters.

This reduction is the result of optimizing the interface between the copper and laminate, specifically controlling copper surface morphology and treatment, as well as the laminate construction and processing. The result is a series of materials that demonstrate reductions in PIM of up to 20dB in both microstrip testing and finished antennas vs. standard laminates. Typical values achieved with Arlon reduced PIM laminates are -155dB or better when tested as described below.

#### **Availability:**

Arlon's reduced PIM laminates are currently available as follows:

<b>Product</b>	<b>Dk (@ 10 GHz)</b>	<b>Df (@ 10 GHz)</b>	<b>Thickness</b>
DiClad 880-PIM	2.17, 2.20	0.0009	0.031"/0.062"
AD250-PIM	2.5	0.0018	0.031"/0.062"
AD300-PIM	3.0	0.003	0.031"/0.062"
AD320-PIM	3.2	0.003	0.062"
AD350-PIM	3.5	0.003	0.030"

#### **PIM Performance Test:**

The following test was conducted to determine the performance of Arlon's reduced PIM laminates: Microstrip test vehicles (12 inch 50 ohm line) and finished antennas were tested using a Summitek Passive Intermodulation Distortion Analyzer. The power level used was two tones with each carrier at 20 watts (+43dBm). The 3rd Order Intermodulation Product was measured in dBc (dB below the carrier peak). The testing was performed at 1900 MHz.

Please note that many factors in both microstrip and antenna testing have a significant impact on PIM results, particularly the print and etch quality of the pcb as well as all elements of the workmanship in the assembly of the microstrip test vehicle or finished antenna. This testing sought to hold these variables constant to isolate the effect of the laminate on intermodulation values.

Teflon is a registered trademark of E.I du Pont Nemours and Company

## Properties & Values

Properties	Test Method	Condition	Typical Values				DiClad PIM	
			AD PIM Series					
			250	300	320	350		880
Dielectric Constant	IPC TM-650 2.5.5.5	C23/50	2.5	3.0	3.2	3.5	2.17, 2.20	
Dissipation Factor	IPC TM-650 2.5.5.5	C23/50	0.0018	0.003	0.003	0.003	0.0009	
Thermal Coefficient of $E_r$ (ppm/°C)	IPC TM-650 2.5.5.5	-10°C to +140°C	-110	-110	-110	-110	-160	
Peel Strength 1/2 ounce	IPC TM-650 2.4.8	n/a	15 lbs	15 lbs	15 lbs	15 lbs	12 lbs	
Peel Strength 1 ounce	IPC TM-650 2.4.8	n/a	17 lbs	17 lbs	17 lbs	17 lbs	12 lbs	
Volume Resistivity (MΩ-cm)	IPC TM-650 2.5.17.1	C96/35/90	$1.2 \times 10^9$	$1.2 \times 10^9$	$1.2 \times 10^9$	$1.2 \times 10^9$	$1.4 \times 10^9$	
Surface Resistivity (MΩ)	IPC TM-650 2.5.17.1	C96/35/90	$4.5 \times 10^7$	$4.5 \times 10^7$	$4.5 \times 10^7$	$4.5 \times 10^7$	$2.9 \times 10^6$	
Arc Resistance (seconds)	ASTM D-495	D48/50	> 180	> 180	> 180	> 180	> 180	
Tensile Modulus (kpsi) x,y	ASTM D-638	A, 23°C	706, 517	706, 517	706, 517	706, 517	267, 202	
Tensile Strength (kpsi) x,y	ASTM D-882	A, 23°C	20.9, 17.3	20.9, 17.3	20.9, 17.3	20.9, 17.3	8.1, 7.5	
Compressive Modulus (kpsi)	ASTM D-695	A, 23°C	365	365	365	365	237	
Flexural Modulus (kpsi)	ASTM D-790	A, 23°C	540	540	540	540	357	
Dielectric Strength (kv)	ASTM D-149	D48/50	> 45	> 45	> 45	> 45	> 45	
Density (g/cm <sup>3</sup> )	IPC TM-650 2.6.2.2	E1/105 + D24/23	2.4	2.4	2.4	2.4	2.23	
Coefficient of Thermal Expansion (ppm/°C)		0°C to 100°C						
			X Axis	12	12	12	12	25
			Y Axis	15	15	15	15	34
			Z Axis	95	95	95	95	252
Thermal Conductivity (W/mK)	ASTM E-1225	100°C	0.235	0.235	0.235	0.235	0.261	
Flammability	UL 94	C48/23/50, E24/125	94V-0	94V-0	94V-0	94V-0	94V-0	
Water Absorption (%)	IPC TM-650 2.6.2.2	E1/105 + D24/23	0.07	0.07	0.07	0.07	0.02	

Data based on 0.062" dielectric thickness, exclusive of metal cladding except where indicated by test method. Results listed above are typical and are not to be used as specification limits. The above information creates no expressed or implied warranties. The properties of PTFE laminates may vary depending on the application, and should be thoroughly tested prior to commercialization.

# ARLON

**MATERIALS FOR ELECTRONICS**

1100 Governor Lea Road, Bear, DE 19701 • Telephone: (302) 834-2100, (800) 635-9333 • Fax: (302) 834-2574  
 9433 Hyssop Drive, Rancho Cucamonga, CA 91730 • Telephone: (909) 987-9533 • Fax: (909) 987-8541  
 37 Rue Collange, 92300 LeVallois, Perret, France • Telephone: (33) 1-427-02642 • Fax: (33) 1-427-02798  
 44 Wilby Avenue, Little Lever, Bolton, Lancashire, BL31QE, U.K. • Telephone: (44) 120-457-6068 • Fax: (44) 120-479-6463  
 E-mail: substrates@arlon-med.com • Website: www.arlon-med.com

**Arlon is an  
ISO 9002  
Registered  
Company**