

DuPont™ Pyralux® AP

All-Polyimide Double-Sided Copper-Clad Laminate

Flexible Circuit Materials

Product Description

DuPont™ Pyralux® AP is a Double-sided Copper-clad Laminate featuring an adhesive-less, all-polyimide dielectric layer. This material is ideal for multilayer flex and rigid-flex applications that required advanced performance, including low loss properties for excellent signal integrity and thermal resistance for high reliability. Available in a range of conductor and dielectric thicknesses, Pyralux® AP clads provide designers and fabricators outstanding options for fabricating high performance circuits.

Key Features and Benefits

- Low loss all-polyimide dielectric for superior signal integrity
- Excellent bond strength affords high reliability
- High thermal resistance to facilitate processing
- Balanced and unbalanced constructions available
- Certified to IPC 4204/11
- UL 94 V-0, UL File E124294
- RoHS Compliant

Packaging

Pyralux® AP Double-side Clad is supplied in sheet form, with standard dimensions of 24 x 36 in (610 x 914 mm), 24 x 18 in (610 x 457 mm), and 12 x 18 in (305 x 457 mm).

Storage and Warranty

DuPont™ Pyralux® AP Double-side Clad should be stored in original packaging at temperatures of 4 - 29 °C (40 - 85 °F) and below 70% relative humidity. The product should not be refrigerated or frozen and should be kept dry, clean, and well protected. Subject to compliance with the foregoing handling and storage recommendations, DuPont's warranties shall remain in effect for the period provided in the DuPont Standard Conditions of Sale. Subject to compliance with the foregoing handling and storage recommendations, DuPont's warranties shall remain in effect for the period provided in the DuPont Standard Conditions of Sale.

Safe Handling

Prior to handling, DuPont recommends referencing the Pyralux® Safe Handling Guide available at pyralux.dupont.com.

Table 1 - Pyralux® AP Construction Options

Laminate Component			
Copper Foil Thickness, μm (oz/ft ²)	6 (0.17)	18 (0.5)	105 (3.0)
	9 (0.25)	35 (1.0)	140 (4.0)
	12 (0.33)	70 (2.0)	
Copper Foil Type	RA, ED, and Double-treated RA		
Dielectric Thickness, μm (mil)	12 (0.5)	50 (2.0)	125 (5.0)
	25 (1.0)	75 (3.0)	150 (6.0)

Table 2 - Standard Pyralux® AP Offerings

Product Code*	Copper Thickness μm (oz/ft ²)	Dielectric Thickness μm (mil)
AP8515R	18 (0.5)	25 (1.0)
AP9111R	35 (1.0)	25 (1.0)
AP9121R	35 (1.0)	50 (2.0)
AP9131R	35 (1.0)	75 (3.0)
AP9141R	35 (1.0)	100 (4.0)
AP9151R	35 (1.0)	125 (5.0)
AP9161R	35 (1.0)	150 (6.0)

*At the end of the product code, "R" designates rolled-annealed copper (e.g., AP9111R), "E" designates electro-deposited copper (e.g., AP9111E), and "D" designates double-treated rolled-annealed copper (e.g., AP9111D).

Pyralux® AP Double-Side Clad Construction Selection

A variety of Pyralux® AP Double-side Clad constructions, both balanced and unbalanced, are commercially available. For help beyond the standard offerings in Table 1, please use the Laminate Product Selector at pyralux.dupont.com to identify the appropriate product code for your copper-clad laminate solution.



Processing

DuPont™ Pyralux® AP Double-side Clad are fully compatible with all conventional flexible circuit fabrication processes, including oxide treatment and wet chemical plated-through-hole de-smearing. Fabricated circuits can be cover coated and laminated together to form multilayers or bonded to heat sinks using polyimide, acrylic, or epoxy adhesives. Pyralux® AP processing guide available from your DuPont sales representative.

DuPont™ Pyralux® AP

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Product Performance

Table 3 - DuPont™ Pyralux® AP Double-sided Copper-clad Laminate Properties

Property	AP9121 Typical Value	Test Method
Dielectric Constant (Dk)		
1 MHz	3.4	IPC-TM-650 2.5.5.3
10 GHz	3.2	ASTM D2520
Loss Tangent (Df)		
1 MHz	0.002	IPC-TM-650 2.5.5.3
10 GHz	0.003	ASTM D2520
Peel Strength (Adhesion to Copper)		
As Received, N/mm (lb/in)	>1.8 (10)	IPC-TM-650 2.4.9
After Solder, N/mm (lb/in)	>1.8 (10)	
Dimensional Stability (MD/TD)		
After Etching, %	± 0.04 to ± 0.08 %	IPC-TM-650 2.2.4
After Thermal (200 °C for 30 min), %	± 0.04 to ± 0.07 %	
Coefficient of Thermal Expansion		
XY-Axis, ppm/°C	Below Tg - 25 / Above Tg 30	IPC-TM-650 2.4.41
Solder Float, 288 °C for 10 s	Pass	IPC-TM-650 2.4.13
Moisture Absorption, %	0.8	IPC-TM-650 2.6.2
Moisture & Insulation Resistance, Ω	> 10 ¹¹	IPC-TM-650 2.6.3.2
Dielectric Strength, V/μm	200	ASTM D149
Volume Resistivity, Ω · cm	> 10 ¹⁷	IPC-TM-650 2.5.17
Surface Resistance, Ω	> 10 ¹⁶	IPC-TM-650 2.5.17
Tensile Modulus, GPa	4.8	IPC-TM-650 2.4.19
Tensile Strength, MPa	345	IPC-TM-650 2.4.19
Elongation, %	50	IPC-TM-650 2.4.19
Flexural Endurance, cycles	6,000	IPC-TM-650 2.4.3
Glass Transition Temperature (Tg), °C	220	DuPont Method, TMA

Data within this table are typical values for the listed product. Performance can vary depending on construction and processing.

Quality and Traceability

DuPont™ Pyralux® AP Double-side Clad is manufactured under a certified ISO9001:2015 Quality Management System facility. Complete material and manufacturing records, which include archive samples of finished product, are maintained by DuPont. Each manufactured lot is identified for reference traceability. The packaging label serves as the primary tracking mechanism in the event of customer inquiry and includes the product name, batch number, size, and quantity.



For more information on DuPont™ AP Double-side Clad or other DuPont products, please visit our website.

pyralux.dupont.com

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EI-10124 (6/22)

DuPont™ Pyralux® AC

All-Polyimide Single-Sided Copper-Clad Laminate

Flexible Circuit Materials



Product Description

DuPont™ Pyralux® AC is a Single-sided Copper-clad Laminate featuring an adhesive-less, all-polyimide dielectric layer. This material exhibits excellent low loss performance and is ideal for use in single-side clad applications that require high density circuitry, along with chip-on-flex attachment. Offered with a variety of conductor types, DuPont™ Pyralux® AC provides designers, fabricators, and assemblers a versatile option to develop their flex circuit solution

Key Features and Benefits

- Low loss all-polyimide dielectric
- ED or RA Cu foil available with various surface treatments
- Excellent thermal resistance from all-polyimide dielectric
- Reliability during flex/bending enabled by excellent peel strength between dielectric and conductor
- Certified to IPC-4204/25
- UL 94V-0, UL File E161336
- RoHS Compliant

Packaging

DuPont™ Pyralux® AC Single-side Clad is supplied as 100 linear meter (328 ft) rolls in widths of either 250 mm (9.8 in) or 500 mm (19.7 in). Other sizes are available by special order.

Storage and Warranty

DuPont™ Pyralux® AC Single-side Clad should be stored in original packaging at temperatures of 4 - 29 °C (40 - 85 °F) and below 70% relative humidity. The product should not be frozen and should be kept dry, clean, and well-protected. Subject to compliance with the foregoing handling and storage recommendations, DuPont's warranties shall remain in effect for the period provided in the DuPont Standard Conditions of Sale.

Safe Handling

Prior to handling, DuPont recommends referencing the Pyralux® Safe Handling Guide available at pyralux.dupont.com.

Table 1 –Pyralux® AC Construction Options

Laminate Component		
Copper Foil		
Thickness, μm (oz/ft ²)	9 (0.25) 12 (0.33)	18(0.5) 35 (1.0)
Copper Foil Type	Rolled-Annealed (RA) Electro-Deposited (ED)	
Dielectric		
Thickness, μm (mil)	12 (0.5) 25 (1.0)	20 (0.8) 45 (1.8)

Table 2 –Pyralux® AC Single Side Clad Offerings

Product Code	Copper Thickness μm (oz/ft ²) & Type	Dielectric Thickness μm (mil)
AC091200EN	09 (0.25) ED	12 (0.5)
AC092500EN	09 (0.25) ED	25 (1.0)
AC121200EM	12 (0.33) ED	12 (0.5)
AC121200RY	12 (0.33) RA	12 (0.5)
AC182500EM	18 (0.5) ED	25 (1.0)
AC182500RY	18 (0.5) RA	25 (1.0)
AC352500RHV	35 (1.0) RA	25 (1.0)
AC354500EY	35 (1.0) ED	45 (1.8)

Pyralux® AC Construction Selection

A variety of Pyralux® AC Single-side Clad constructions, are commercially available. For help beyond the standard offerings in Table 2, please use the Laminate Product Selector at pyralux.dupont.com to identify the appropriate product code for your copper-clad laminate solution.



Processing

DuPont™ Pyralux® AC Single-side Clad is fully compatible with all conventional flexible circuit fabrication processes, including oxide treatment and wet chemical plated-through-hole de-smearing. Fabricated circuits can be cover-coated and laminated together to form multilayers or bonded to heat sinks using polyimide, acrylic, or epoxy adhesives. Pyralux® AC processing guide available from your DuPont sales representative.

Product Performance

Table 3 - DuPont™ Pyralux® AC Single-side Clad Properties

Property	Typical Values AC182500RY	Test Method
Dielectric Constant (Dk)		
1 MHz	3.7	IPC-TM-650 2.5.5.3
10 GHz	3.4	ASTM D2520
Loss Tangent (Df)		
1 MHz	0.003	IPC-TM-650 2.5.5.3
10 GHz	0.005	ASTM D2520
Adhesion to Copper (Peel Strength)		
As Received, N/mm (lb/in)	1.2 (6 - 7)	IPC-TM-650 2.4.9
After Solder, N/mm (lb/in)	1.2 (6 - 7)	
Dimensional Stability (MD/TD)		
After Etching, %	± 0.02 %	DuPont Method, TMA
After Thermal (200 °C for 30 min), %	± 0.04 %	
Coefficient of Thermal Expansion		
XY-Axis, ppm/°C	19	IPC-TM-650 2.4.41
Solder Float, 288 °C for 10 s	Pass	IPC-TM-650 2.4.13
Moisture Absorption, %	0.9	IPC-TM-650 2.6.2
Volume Resistivity, Ω·cm	> 10 ¹⁶	IPC-TM-650 2.5.17
Surface Resistance, Ω	> 10 ¹²	IPC-TM-650 2.5.17
Tensile Modulus, GPa	> 7.5	IPC-TM-650 2.4.19
Tensile Strength, MPa	> 190	IPC-TM-650 2.4.19
Elongation, %	21	IPC-TM-650 2.4.19
Flexural Endurance, cycles	> 60	JIS C6471 (MIT)
Glass Transition Temperature (Tg), °C	280	DuPont Method, TMA

Data within this table are typical values for the listed product. Performance can vary depending on construction and processing.

Quality and Traceability

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For more information on Pyralux® AC Single-side Clad or other DuPont products, please visit electronics.dupont.com.

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