

DuPont™ Pyralux® FR Copper-Clad Laminates

flexible composites

Technical Information

Description

DuPont™ Pyralux® FR copper-clad laminate is a composite of DuPont™ Kapton® polyimide film with copper foil on one or both sides, bonded together with a proprietary, flame-retardant, C-staged acrylic adhesive. Pyralux® FR flexible composites are recommended for use in singlesided, double-sided, multilayer, and rigid-flex circuits that require flame retardancy. All copper-clad laminates are available with rolled, annealed copper or electrodeposited copper. In addition, both types are available with double-treated copper (nodules of electro-deposited copper on both sides of the copper foil). Doubletreated copper, if used, eliminates surface preparation steps prior to resist or coverlay lamination.

Construction

Copper-clad laminates are available in a variety of film thicknesses and copper weights. **Tables 1** and **2** list typical constructions.

The product code must be used when ordering copper-clad laminates from DuPont.

Packaging

Pyralux® FR copper-clad laminates are supplied in 24 in (610 mm) by 36 in (914 mm) sheets. There is a minimum of four sheets and a maximum of 25 sheets per pack.

Typical Data

Each manufactured lot, except the laminate constructions noted in **Tables 1** and **2**, is certified to IPC specifications and tested according to IPC Test Method TM-650. See **Table 3**.

A Certificate of Conformance is available with every batch. Complete material and manufacturing records for each lot, with samples of finished laminate, are retained for reference purpose. The roll labels contain the lot number, DuPont order number, customer order number, IPC specification, customer specification, and customer part number; save these labels for reference in case of inquiries.

Table 1
Single-Sided Copper-Clad Product Codes

Product Code*	Copper	Adhesive	Kapton®	IPC
	oz/ft² (g/m²)	Mil (µm)	Mil (µm)	Cert.**
FR9110R	1 (305)	1 (25)	1 (25)	Yes
FR9120R	1 (305)	1 (25)	2 (51)	Yes
FR9130R	1 (305)	1 (25)	3 (76)	Yes
FR9150R	1 (305)	1 (25)	5 (127)	Yes
FR9210R	2 (610)	1 (25)	1 (25)	Yes
FR9220R	2 (610)	1 (25)	2 (51)	Yes
FR7012R	1/2 (153)	1/2 (13)	1/2 (13)	No
FR7002R	1 (305)	1/2 (13)	1/2 (13)	No
FR7062R	1/2 (153)	1/2 (13)	1 (25)	No
FR7011R	1 (305)	1/2 (13)	1 (25)	Yes
FR7008R	2 (610)	1/2 (13)	1 (25)	Yes
FR7092R	1 (305)	1/2 (13)	2 (51)	Yes
FR7004R	1/2 (153)	1 (25)	1/2 (13)	No
FR7037R	1 (305)	1 (25)	1/2 (13)	No
FR7038R	2 (610)	1 (25)	1/2 (13)	No
FR8510R	1/2 (153)	1 (25)	1 (25)	Yes
FR7031R	3/4 (229)	1 (25)	1 (25)	Yes
FR8520R	1/2 (153)	1 (25)	2 (51)	Yes
FR7019R	3/4 (229)	1 (25)	2 (51)	Yes
FR7097R	1 (305)	2 (51)	1 (25)	Yes

*Add "R" to the end of the code to specify rolled-annealed copper (e.g., FR9210R). Add "E" to the end of the code to specify electro-deposited copper (e.g., FR9210E). If rolled annealed double-treated copper is specified, add the letter "D" to the end of the product code (e.g., FR9210D).
**Certified to IPC-4204/1: "Flexible Metal-Clad Dielectrics for use in Fabrication of Flexible Printed Wiring."



The miracles of science™

Table 2
Double-Sided Copper-Clad Product Codes

Product Code*	Copper	Adhesive	Kapton®	IPC
	oz/ft ² (g/m ²)	Mil (µm)	Mil (µm)	Cert.**
FR9111R	1 (305)	1 (25)	1 (25)	Yes
FR9121R	1 (305)	1 (25)	2 (51)	Yes
FR9131R	1 (305)	1 (25)	3 (76)	Yes
FR9151R	1 (305)	1 (25)	5 (127)	Yes
FR9212R	2 (610)	1 (25)	1 (25)	Yes
FR9222R	2 (610)	1 (25)	2 (51)	Yes
FR7022R	1/2 (153)	1/2 (13)	1/2 (13)	No
FR7014R	1/2 (153)	1/2 (13)	1 (25)	No
FR7010R	1 (305)	1/2 (13)	1 (25)	Yes
FR7041R	2 (610)	1/2 (13)	1 (25)	Yes
FR7091R	1/2 (153)	1/2 (13)	2 (51)	Yes
FR7093R	1 (305)	1/2 (13)	2 (51)	Yes
FR7058R	2 (610)	1/2 (13)	2 (51)	Yes
FR7003R	2 (610)	1/2 (13)	3 (76)	No
FR7017R	1/2 (153)	1 (25)	1/2 (13)	No
FR7039R	1 (305)	1 (25)	1/2 (13)	No
FR7040R	2 (610)	1 (25)	1/2 (13)	No
FR8515R	1/2 (153)	1 (25)	1 (25)	Yes
FR8525R	1/2 (153)	1 (25)	2 (51)	Yes
FR7090R	2 (610)	2 (51)	2 (51)	Yes
FR7071R	1 (305)	1/2 (13)	1/2 (13)	Yes

*Add "R" to the end of the code to specify rolled-annealed copper (e.g., FR9210R). Add "E" to the end of the code to specify electro-deposited copper (e.g., FR9210E). If rolled annealed double-treated copper is specified, add the letter "D" to the end of the product code (e.g., FR9210D).
**Certified to IPC-4204/1: "Flexible Metal-Clad Dielectrics for use in Fabrication of Flexible Printed Wiring."

Table 3
Pyralux® FR Copper-Clad Properties

Property	Typical Copper-Clad Value	Test Method
Flammability	VTM-0	UL94
Meets UL796 Direct Support Requirements	Yes	UL796
Peel Strength After lamination After soldering	— 2.1 N/mm (12 lb/in) 1.9 N/mm (11 lb/in)	IPC-TM-650, No. 2.4.9 Method B Method D
Solder Float Resistance 10 sec at 288°C (550°F)	Pass	IPC-TM-650, No. 2.4.13 Method B
Thickness Tolerance	±10%	IPC-TM-650, No. 4.6.2
Dimensional Stability	-0.10% -0.10%	IPC-TM-650, No. 2.2.4 Method B Method C
Dielectric Constant (at 1 MHz)	3.5	IPC-TM-650, No. 2.5.5.3
Dissipation Factor (at 1 MHz)	0.02	IPC-TM-650, No. 2.5.5.3
Dielectric Strength	137 kV/mm (3500 V/mil)	ASTM D-149
Insulation Resistance (at ambient)	10 ⁶ megohms	IPC-TM-650, No. 2.6.3.2
Volume Resistivity (at ambient)	10 ⁹ megohm-cm	ASTM D-257
Surface Resistance (at ambient)	10 ⁷ megohms	ASTM D-257

The values in Table 3 represent a typical 1 oz. RA copper foil, 1 mil adhesive and 1 mil Kapton® construction.

Processing

Laminating conditions for DuPont™ Pyralux® flexible composites are typically in the following ranges:

Part Temperature: 182–199°C (360–390°F)
Pressure: 14–28 kg/cm² (200–400 psi)
Time: 1–2 hours, at temperature

Pyralux® FR can be processed like Pyralux® LF. Refer to publication "Pyralux® Flexible Composites Technical Manual" for further processing details.

Storage Conditions and Warranty

Pyralux® FR flexible laminates should be stored in the original packaging at temperatures of 4–29°C (40–85°F) and below 70% 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 as provided in the DuPont Standard Conditions of Sale shall remain in effect for a period of two years following the date of shipment.

Safe Handling

Pyralux® FR overlayer, sheet adhesive, and bond ply contain a B-staged adhesive. Since B-staged adhesive contains trace quantities (parts per million) of unreacted monomers, operators should take care to minimize contact.

Pyralux® FR copper-clad laminates contain fully cured (C-staged) adhesive.

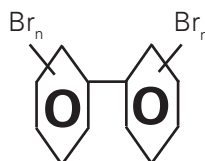
Although DuPont is not aware of anyone developing contact dermatitis when using Pyralux® FR products, some individuals may be more sensitive than others. Anyone handling Pyralux® FR copper-clad laminates should wash their hands with soap before eating, smoking, or using restroom facilities. Gloves, finger cots, and finger pads should be changed daily. Clothes should be washed frequently.

The unreacted acrylic monomer in the adhesive may impart a mild odor when the release film or paper is removed. We recommend that areas where B-staged materials are used, as well as lay-up and lamination areas, be well ventilated with a fresh air supply.

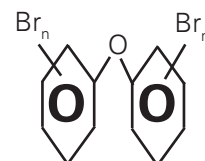
Pyralux® adhesive is cured during lamination. The curing reaction does not produce any vapors, although impurities may volatilize. When drilling or routing parts made with Pyralux® FR flexible composites, provide adequate vacuum around the drill head to minimize worker exposure to adhesive dust.

Thin copper-clad laminates can have sharp metal edges. People handling these materials should be cautioned and provided with suitable gloves to prevent cuts.

Pyralux® FR flexible composites DO NOT contain polybrominated biphenyls (PBBs), polybrominated biphenyl oxides (PBBOs), or polybrominated diphenyl ethers (PBDEs).



PBB



PBBO

For more information on DuPont™ Pyralux® flexible circuit materials , please contact your local representative, or visit our website:

Americas

DuPont Electronic Technologies
14 T. W. Alexander Drive
Research Triangle Park, NC 27709
Tel: 800-243-2143

Europe, Middle East & Africa

DuPont de Nemours (Luxembourg) s.à r.l.
Rue Général Patton, Contern
L-2984 Luxembourg
Tel: +352 3666 5654

Japan

DuPont KK
Sanno Park Tower
11-1, Nagata-cho 2-chome
Chiyoda-ku, Tokyo 100-6111
Tel: 81-3-5521-8660

Taiwan

DuPont Taiwan Hsinchu Branch.
#2, Li-Hsin 4th Rd., Hsinchu Science Park,
Hsinchu 30078, Taiwan
Tel: 886-3-5793654

India

E.I.DuPont India Limited
1001-1012 "Meadows", 10th Floor
Sahar Plaza Complex
Andheri-Kurla Road, Andheri
(East)
Mumbai 400 059, India

Tel: 91-22-6751-5000
DID: 91-22-6751-5038
Fax : 91-22-67101937

China

DuPont China Holding Co., Ltd.
Shanghai Branch
Bldg. 11, 399 Keyuan Road
Zhangjiang Hi-Tech Park
Pudong New District
Shanghai 201203, China
Tel: 86-21-38622720

Korea

DuPont Korea Inc.
4/5 Floor, Asia Tower
#726, Yeoksam-dong, Kangnam-ku,
Seoul
135-082 Korea
Tel: 82-2-2222-5224

Singapore

DuPont Singapore Pte, Ltd.
1 HarbourFront Place #11-01
HarbourFront Tower One
Singapore 098633
Tel: 65-6586-3091

pyralux.dupont.com

Copyright ©2011 DuPont or its affiliates. All rights reserved. The DuPont Oval, DuPont™, The miracles of science™, Pyralux® and Kapton® are registered trademarks or trademarks of E.I. du Pont de Nemours and Company or its affiliates.

NO PART OF THIS MATERIAL MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM OR TRANSMITTED IN ANY FORM OR BY ANY MEANS ELECTRONIC, MECHANICAL, PHOTOCOPYING, RECORDING OR OTHERWISE WITHOUT THE PRIOR WRITTEN PERMISSION OF DUPONT.

Caution: Do not use in medical applications involving permanent implantation in the human body. For other medical applications, see "DuPont Medical Caution Statement," H-50102.

This information is based on data believed to be reliable, but DuPont makes no warranties, express or implied, as to its accuracy and assumes no liability arising out of its use. The data listed herein falls within the normal range of product properties but should not be used to establish specification limits or used alone as the basis of design. Because DuPont cannot anticipate or control the many different conditions under which this information and/or product may be used, it does not guarantee the usefulness of the information or the suitability of its products in any given application. Users should conduct their own tests to determine the appropriateness of the product for their particular purposes.

This information may be subject to revision as new knowledge and experience become available. This publication is not to be taken as a license to operate under, or recommendation to infringe, any patent.

H-73233-7 11/11



The miracles of science™