

DuPont™ Pyralux® APR

All-Polyimide Embedded Resistor Laminate

Flexible Circuit Materials

Product Description

DuPont™ Pyralux® APR Resistor Laminate features an adhesive-less, all-polyimide dielectric layer in combination with TCR® Thin-Film Embedded Resistor Copper Foil from Ticer Technologies. This material system is ideal for multilayer flex, rigid-flex, and rigid PCB applications which require reliable embedded resistor technology, advanced material performance, temperature resistance, high reliability, and robust processing. Offered in a wide range of dielectric thicknesses and resistance levels, Pyralux® APR provides designers, fabricators, and assemblers a versatile option for circuit fabrication.

Key Features and Benefits

- Excellent resistive and dielectric layer tolerance and electrical performance
- Embedded capacitance and resistance in a single laminate
- 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® APR Resistor Laminate 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), 24 x 12 in (610 x 305 mm), and 12 x 18 in (305 x 457 mm).

Storage and Warranty

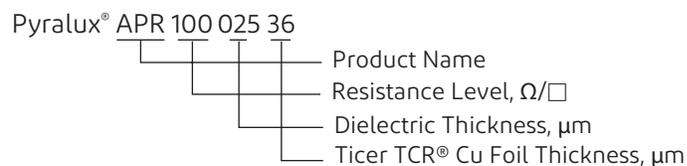
DuPont™ Pyralux® APR Resistor Laminate should be stored in original packaging at temperatures of 4 - 29 °C (40 - 85 °F) and below 70% relative humidity. The product should not be frozen and should be kept dry, clean, and well-protected. Subject to compliance with the foregoing handling and storage recommendations, DuPont's warranties as provided in the DuPont Standard Conditions of Sale shall remain in effect for a period of two years following the date on the Certificate of Analysis.

Table 1 - Standard Pyralux® APR Offerings

| Product Code* | Sheet Resistance (Ω/□) | Copper Thickness μm (oz/ft ²) | Dielectric Thickness μm (mil) |
|---------------|------------------------|---|-------------------------------|
| APR02502536NC | 25 | 35 (1.0) | 25 (1.0) |
| APR02502518NC | 25 | 18 (0.5) | 25 (1.0) |
| APR02505036NC | 25 | 35 (1.0) | 50 (2.0) |
| APR10002536NC | 100 | 35 (1.0) | 25 (1.0) |
| APR10002518NC | 100 | 18 (0.5) | 25 (1.0) |
| APR10005036NC | 100 | 35 (1.0) | 50 (2.0) |

*Resistor type for all listed products above is NiCr. Additional Ticer Technologies TCR® foil types (e.g., NiCrAlSi) are available with Ω/□ levels of 10, 25, 50, 100, and 200.

Product Code Key



Processing

DuPont™ Pyralux® APR Resistor Laminate is fully compatible with all conventional flexible circuit fabrication processes. Resistor formation requires a 2 or 3 step etch process, depending on the resistor material type. Common etchant chemistries are suitable for use. Pyralux® APR processing guide available from your DuPont sales representative.

Safe Handling

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

Quality and Traceability

DuPont™ Pyralux® APR Resistor Laminate 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.

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Product Performance

Table 2 - DuPont™ Pyralux® APR Resistor Laminate Properties

| Property | APR02505036NC Typical Value | Test Method |
|--|-----------------------------|--------------------|
| Sheet Resistance (Ω/\square) | 25 | IPC-TM-650 2.5.14 |
| Peel Strength (Adhesion to Copper) | | |
| As Received, N/mm (lb/in) | 1.4 (8) | IPC-TM-650 2.4.9 |
| After Solder, N/mm (lb/in) | 1.4 (8) | |
| Dimensional Stability (MD/TD) | | |
| After Etching, % | ± 0.04 to $\pm 0.08\%$ | IPC-TM-650 2.2.4 |
| After Thermal (200 °C for 30 min), % | ± 0.04 to $\pm 0.07\%$ | |
| 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 | $> 10^{17}$ | IPC-TM-650 2.6.3.2 |
| Dielectric Strength, V/ μm | 200 | ASTM D149 |
| Volume Resistivity, $\Omega \cdot \text{cm}$ | $> 10^{16}$ | 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.



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For more information on DuPont™ Pyralux® APR Resistor Laminate or other DuPont products, please visit our website.

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CAUTION: Do not use in medical applications involving permanent implantation in the human body. For other medical applications, see "DuPont Medical Caution Statement," H-50102-5 and "DuPont Policy Regarding Medical Applications" H-50103-5.

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