High Frequency Circuit Materials



RO4000® hydrocarbon ceramic laminates are designed to offer superior high frequency performance and low cost circuit fabrication. The result is a low loss material which can be fabricated using standard epoxy/glass (FR-4) processes offered at competitive prices.

The selection of laminates typically available to designers is significantly reduced once operational frequencies increase to 500 MHz and above. RO4000 material possesses the properties needed by designers of RF microwave circuits and matching networks and controlled impedance transmission lines. Low dielectric loss allows RO4000 series material to be used in many applications where higher operating frequencies limit the use of conventional circuit board laminates. The temperature coefficient of dielectric constant is among the lowest of any circuit board material (Chart 1), and the dielectric constant is stable over a broad frequency range (Chart 2). For reduced insertion loss, LoPro® foil is available (Chart 3). This makes it an ideal substrate for broadband applications.

RO4000 material's thermal coefficient of expansion (CTE) provides several key benefits to the circuit designer. The expansion coefficient of RO4000 material is similar to that of copper which allows the material to exhibit excellent dimensional stability, a property needed for mixed dielectric multi-layer boards constructions. The low Z-axis CTE of RO4000 laminates provides reliable plated through-hole quality, even in severe thermal shock applications. RO4000 series material has a Tg of >280°C (536°F) so its expansion characteristics remain stable over the entire range of circuit processing temperatures.

RO4000 series laminates can easily be fabricated into printed circuit boards using standard FR-4 circuit board processing techniques. Unlike PTFE based high performance materials, RO4000 series laminates do not require specialized via preparation processes such as sodium etch. This material is a rigid, thermoset laminate that is capable of being processed by automated handling systems and scrubbing equipment used for copper surface preparation.

RO4003C™ laminates are currently offered in various configurations utilizing both 1080 and 1674 glass fabric styles, with all configurations meeting the same laminate electrical performance specification. Specifically designed as a drop-in replacement for the RO4003C™ material, RO4350B™ laminates utilize RoHS compliant flame-retardant technology for applications requiring UL 94V-0 certification. These materials conform to the requirements of IPC-4103, slash sheet /10 for RO4003C, see note #1 for RO4350B slash sheet determination.



FEATURES AND BENEFITS:

RO4000 materials are reinforced hydrocarbon/ceramic laminates - not PTFE
- Designed for performance sensitive, high volume applications

Low dielectric tolerance and low loss
- Excellent electrical performance
- Allows applications with higher operating frequencies
- Ideal for broadband applications

Stable electrical properties vs. frequency
- Controlled impedance transmission lines
- Repeatable design of filters

Low thermal coefficient of dielectric constant
- Excellent dimensional stability

Low Z-axis expansion
- Reliable plated through holes

Low in-plane expansion coefficient
- Remains stable over an entire range of circuit processing temperatures

Volume manufacturing process
- RO4000 laminates can be fabricated using standard glass epoxy processes
- Competitively priced

CAF resistant

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Chart 1: RO4000 Series Materials Dielectric Constant vs. Temperature



Chart 2: RO4000 Series Materials Dielectric Constant vs. Frequency

NOTES:

(1) RO4350B 4 mil laminates have a process Dk of 3.33 ± 0.05 and are in conformance with IPC-4103A/240. All other RO4350B laminate thicknesses are /11 and /240 compliant.
(2) The design Dk is an average number from several di□erent tested lots of material and on the most common thickness/s. If more detailed information is required, please contact Rogers Corporation or refer to Rogers' technical papers in the Rogers Technology Support Hub available at http://www.rogerscorp.com.
(3) RO4350B LoPro® laminates do not share the same UL designation as standard RO4350B laminates. A separate UL quali□cation may be necessary.

Typical values are a representation of an average value for the population of the property. For speci□cation values contact Rogers Corporation.

RO4000 LoPro laminate uses a modi□ed version of the RO4000 resin system to bond reverse treated foil. Values shown above are RO4000 laminates without the addition of the LoPro resin. LoPro foil results in an overall thickness increase of approximately 0.0007" (18µm) per core.

The LoPro Resin Dk is approximately 2.4. **However, when used in combination with the base laminate system, the average design Dk noted in the data sheet table should be used.** (The design Dk value decreases by about 0.1 as the core thickness decreases from 0.020" to 0.004".)

Prolonged exposure in an oxidative environment may cause changes to the dielectric properties of hydrocarbon based materials. The rate of change increases at higher

Standard Thickness	Standard Panel Size	Standard Copper Cladding
RO4003C: 0.008" (0.203mm), 0.012 (0.305mm), 0.016"(0.406mm), 0.020" (0.508mm) 0.032" (0.813mm), 0.060" (1.524mm) RO4350B: *0.004" (0.101mm), 0.0066" (0.168mm) 0.010" (0.254mm), 0.0133" (0.338mm), 0.0166" (0.422mm), 0.020"(0.508mm), 0.030" (0.762mm), 0.060"(1.524mm) Note: Material clad with LoPro foil add 0.0007" (0.018mm) to dielectric thickness	12" X 18" (305 X457 mm) 24" X 18" (610 X 457 mm) 24" X 36" (610 X 915 mm) 48" X 36" (1.224 m X 915 mm) *0. 004" (0.101mm) material is not available in panel sizes larger than 24"x18" (610 X 457mm)	½ oz. (17µm) electrodeposited copper foil (.5ED/.5ED) 1 oz. (35µm) electrodeposited copper foil (1ED/1ED) 2 oz. (70µm) electrodeposited copper foil (2ED/2ED) PIM Sensitive Applications: ½ oz (17µm) LoPro Reverse Treated EDC (.5TC/.5TC) 1 oz (35µm) LoPro Reverse Treated EDC (1TC/1TC)

The information in this data sheet is intended to assist you in designing with Rogers' circuit materials. It is not intended to and does not create any warranties express or implied, including any warranty of merchantability or tness for a particular purpose or that the results shown on this data sheet will be achieved by a user for a particular purpose. The user should determine the suitability of Rogers' circuit materials for each application.

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