

RO3000® Series Circuit Materials

RO3003™, RO3006™ and RO3010™

High Frequency Laminates

RO3000® high frequency circuit materials are ceramic-filled PTFE composites intended for use in commercial microwave and RF applications. This family of products was designed to offer exceptional electrical and mechanical stability at competitive prices.

RO3000 series laminates are circuit materials with mechanical properties that are consistent regardless of the dielectric constant selected. This allows the designer to develop multi-layer board designs that use different dielectric constant materials for individual layers, without encountering warpage or reliability problems.

The dielectric constant versus temperature of RO3000 series materials is very stable (Charts 1 and 2). These materials exhibit a coefficient of thermal expansion (CTE) in the X and Y axis of 17 ppm/°C. This expansion coefficient is matched to that of copper, which allows the material to exhibit excellent dimensional stability, with typical etch shrinkage (after etch and bake) of less than 0.5 mils per inch. The Z-axis CTE is 24 ppm/°C, which provides exceptional plated through-hole reliability, even in severe thermal environments.

RO3000 series laminates can be fabricated into printed circuit boards using standard PTFE circuit board processing techniques, with minor modifications as described in the application note "Fabrication Guidelines for RO3000 Series High Frequency Circuit Materials."

RO3000 laminates are manufactured under an ISO 9002 certified system.



FEATURES AND BENEFITS:

Low dielectric loss (RO3003™ laminates)

- Laminates can be used in applications up to 77 GHz.

Excellent mechanical properties versus temperature

- Reliable stripline and multi-layer board constructions.

Uniform mechanical properties for a range of dielectric constants

- Ideal for multi-layer board designs with a range of dielectric constants
- Suitable for use with epoxy glass multi-layer board hybrid designs

Stable dielectric constant versus temperature and frequency (RO3003 laminates)

- Ideal for band pass filters, microstrip patch antennas, and voltage controlled oscillators.

Low in-plane expansion coefficient (match to copper)

- Allows for more reliable surface mounted assemblies
- Ideal for applications sensitive to temperature change
- Excellent dimensional stability

Volume manufacturing process

- Economical laminate pricing

SOME TYPICAL APPLICATIONS:

- Automotive radar applications
- Global positioning satellite antennas
- Cellular telecommunications systems - power amplifiers and antennas
- Patch antenna for wireless communications
- Direct broadcast satellites
- Datalink on cable systems
- Remote meter readers
- Power backplanes

Chart 1: RO3003 Laminate Dielectric Constant vs. Temperature

The data in Chart 1 demonstrates the excellent stability of dielectric constant over temperature for RO3003 laminates, including the elimination of the step change in dielectric constant, which occurs near room temperature with PTFE glass materials.

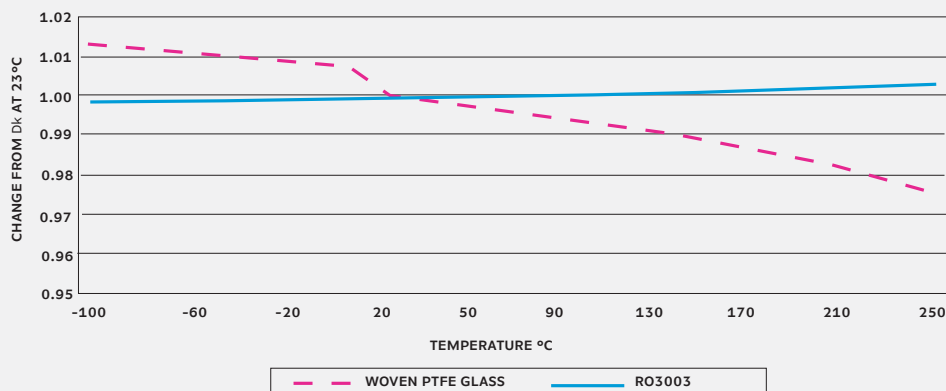


Chart 2: RO3006 and RO3010 Laminate Dielectric Constant vs. Temperature

The data in Chart 2 shows the change in dielectric constant vs. temperature for RO3006™ and RO3010™ laminates. These materials exhibit significant improvement in temperature stability of dielectric constant when compared to other high dielectric constant PTFE laminates.

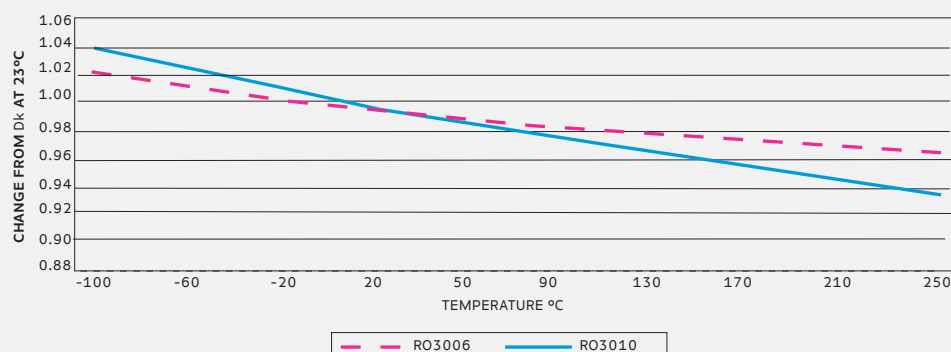
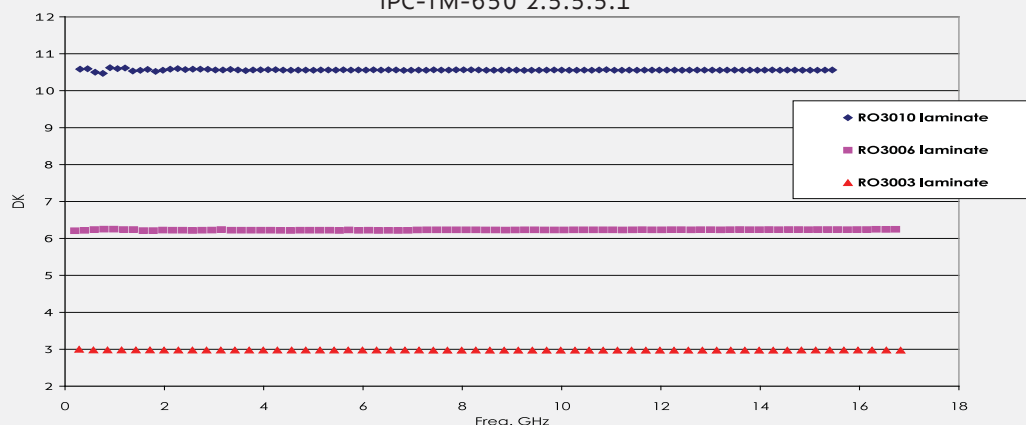


Chart 3: RO3000 Series Laminates Dielectric Constant vs. Frequency
IPC-TM-650 2.5.5.5.1

Chart 3 demonstrates the stability of dielectric constant for RO3000 series products over frequency. This stability simplifies the design of broadband components as well as allowing the materials to be used in a wide range of applications over a very broad range of frequencies.



Property	Typical Value ⁽¹⁾			Direction	Unit	Condition	Test Method
	RO3003	RO3006	RO3010				
Dielectric Constant, ϵ_r Process	3.00 $\pm$ 0.04	6.15 $\pm$ 0.15	10.2 $\pm$ 0.30	Z	-	10 GHz 23°C	IPC-TM-650 2.5.5.5 Clamped Stripline
⁽²⁾ Dielectric Constant, ϵ_r Design	3.00	6.50	11.20	Z	-	8 GHz - 40 GHz	Differential Phase Length Method
Dissipation Factor, $\tan \delta$	0.0013	0.0020	0.0022	Z	-	10 GHz 23°C	IPC-TM-650 2.5.5.5
Thermal Coefficient of ϵ_r	13	-160	-280	Z	ppm/°C	10 GHz 0-100°C	IPC-TM-650 2.5.5.5
Dimensional Stability	0.01	0.5	0.5	X,Y	mm/m	COND A	ASTM D257
Volume Resistivity	10 ⁷	10 ⁵	10 ⁵		MΩ•cm	COND A	IPC 2.5.17.1
Surface Resistivity	10 ⁷	10 ⁵	10 ⁵		MΩ	COND A	IPC 2.5.17.1
Tensile Modulus	900	2068	1500	X, Y	MPa	23°C	ASTM D638
Water Absorption	<0.1	<0.1	<0.1	-	%	D24/23	IPC-TM-650 2.6.2.1
Specific Heat	0.9	0.86	0.8		J/g/K		Calculated
Thermal Conductivity	0.50	0.79	0.95	-	W/m/K	80°C	ASTM C518
Coefficient of Thermal Expansion	17	17	13	X	ppm/°C	-55 to 288°C	ASTM D3386-94
	16	17	11	Y			
	25	24	16	Z			
Td	500	500	500		°C TGA		ASTM D3850
Density	2.1	2.6	2.8		gm/cm ³		
Copper Peel Strength	12.7	7.1	9.4		lb/in	1 oz. EDC After Solder Float	IPC-TM-2.4.8
Flammability	V-0	V-0	V-0				UL 94
Lead Free Process Compatible	YES	YES	YES				



NOTES:

- (1) Typical values are a representation of an average value for the population of the property. For specification values contact Rogers Corporation.
- (2) The design Dk is an average number from several different 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 Roger Technology Support Hub available at <http://www.rogerscorp.com/acm/technology>.

Standard Thickness	Standard Panel Size	Standard Copper Cladding
RO3003: 0.005" (0.13mm) 0.010" (0.25mm) 0.020" (0.50mm) 0.030" (0.75mm) 0.060" (1.52mm)	RO3003/RO3006/RO3010: 12" X 18" (305 X 457mm) 24" X 18" (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)
		Other claddings may be available. Contact customer service.
RO3006/RO3010: 0.005" (0.13mm) 0.010" (0.25mm) 0.025" (0.64mm) 0.050" (1.28mm)		

The information in this data sheet is intended to assist you in designing with Rogers' circuit material laminates. It is not intended to and does not create any warranties express or implied, including any warranty of merchantability or fitness 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 material laminates for each application.

These commodities, technology and software are exported from the United States in accordance with the Export Administration regulations. Diversion contrary to U.S. law prohibited.

The world runs better with Rogers. and the Rogers' logo are licensed trademarks of Rogers Corporation.
 RO3000, RO3003, RO3006, RO3010 are licensed trademarks of Rogers Corporation.
 © 1993, 2002, 2004, 2005, 2010, 2011 Rogers Corporation, Printed in U.S.A., All rights reserved.
 Revised 11/2011, 0952-1111-CC Publication #92-130 REV2