

High Frequency Circuit Materials

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RO3000™ Series High Frequency Circuit Materials

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 is a line of PTFE materials with mechanical properties that are the same regardless of dielectric constant. 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 thermal coefficient of 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."

Cladding options include ½ to 2 oz./ft² (17 to 68 µm thick) electrodeposited copper.

RO3000 laminates are manufactured under an ISO 9002 certified system.

RO3000™ Laminate Product Information:

PROPERTY	TYPICAL VALUE			DIRECTION	UNIT	CONDITION	TEST METHOD
	RO3003	RO3006	RO3010				
Dielectric Constant ϵ_r	3.0 ± 0.04 ⁽²⁾	6.15 ± 0.15	10.2 ± 0.30	Z	-	10 GHz 23 C	IPC-TM-650 2.5.5.5
Thermal Coefficient of ϵ_r	13	-169	-295	Z	ppm/ C	10 GHz 0-100 C	IPC-TM-650 2.5.5.5
Dissipation Factor	0.0013	0.0025	0.0035	Z	-	10 GHz-23 C	IPC-TM-650 2.5.5.5
Dimensional Stability	0.5	0.5	0.5	X,Y	mm/m	A	ASTM D257
Volume Resistivity	10 ⁶	10 ³	10 ³	Z	Mohm-cm	A	IPC 2.5.17.1
Surface Resistivity	10 ⁷	10 ³	10 ³	A	Mohm	A	IPC 2.5.17.1
Tensile Modulus	2070 (300)	2070 (300)	2070 (300)	X,Y	MPa (kpsi)	23 C	ASTM D638
Water Absorption	<0.1	<0.1	<0.1	-	%	D24/23	IPC-TM-650 2.6.2.1
Specific Gravity	2.1	2.6	3.0	-	-	23 C	ASTM D792
Copper Peel Strength	3.1 (17.6)	2.1 (12.2)	2.4 (13.4)	-	N/mm (lb/in)	After Solder Float	IPC-TM-650 2.4.8
Specific Heat	0.93 (0.22)	0.93 (0.22)	0.93 (0.22)	-	J/g/K (BTU/lb/ F)	-	Calculated
Thermal Conductivity	0.50	0.61	0.66	-	W/m/K	100 C	ASTM C518
Coefficient of Thermal Expansion	17 24	17 24	17 24	X,Y Z	ppm/ C	-55 to 288 C	ASTM D3386-94
Color	Tan	Tan	Off White	-	-	-	-
Density	2.1	2.6	3.0	-	gm/cm ³	-	-
UL Flammability Rating	94V-0	94V-0	94V-0	-	-	-	-

(1) References: Internal T.R.'s 1430, 2224, 2854. Tests at 23°C unless otherwise noted. Typical values should not be used for specification limits.

(2) The nominal dielectric constant of an 0.060" thick RO3003 laminate as measured by the IPC-TM-650, 2.5.5.5 will be 3.02, due to the elimination of biasing caused by air gaps in the test fixture. For further information refer to Rogers T.R. 5242.

The data in Charts 1, 2 and 3 was produced using a modified IPC TM-650, 2.5.5.5 method. For additional information request Rogers T.R. 5156 and T.M. 4924.

Chart 1: RO3003 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.

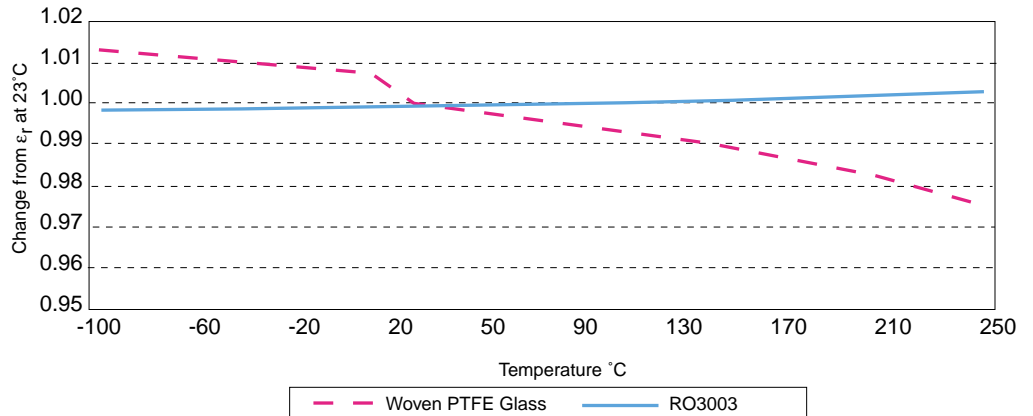


Chart 2: RO3006 and RO3010 Dielectric Constant vs. Temperature

The data in Chart 2 shows the change in dielectric constant vs temperature for RO3006 and 3010 laminates. These materials exhibit significant improvement in temperature stability of dielectric constant when compared to other high dielectric constant PTFE laminates.

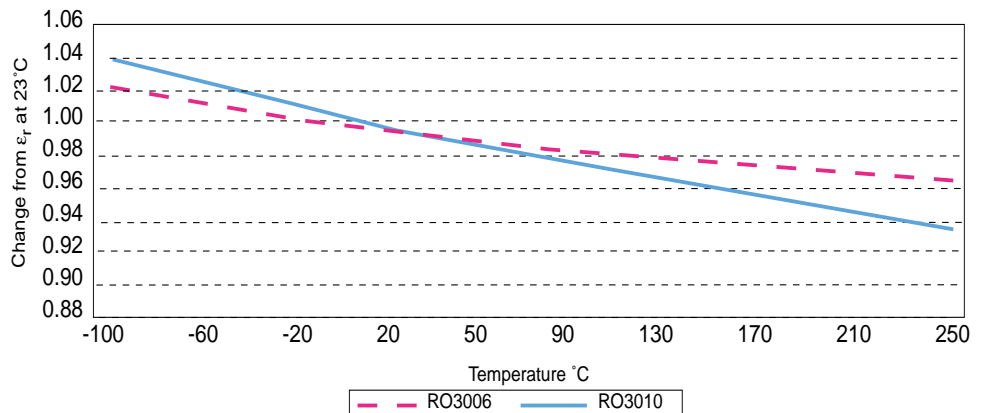
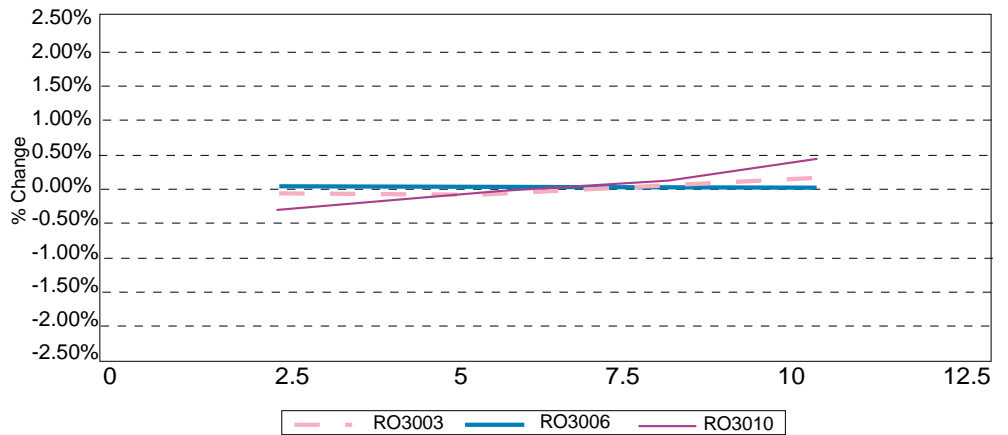


Chart 3: Dielectric Constant vs. Frequency for RO3000 Series Laminate

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



Ordering Information:

Available Configurations: Thicknesses and Tolerance

RO3003	RO3006	RO3010
0.005" ± 0.0005" (0.13 ± 0.01 mm)	0.005" ± 0.0005" (0.13 ± 0.01 mm)	0.005" ± 0.0005" (0.13 ± 0.01 mm)
0.010" ± 0.0007" (0.25 ± 0.02 mm)	0.010" ± 0.0007" (0.25 ± 0.02 mm)	0.010" ± 0.0007" (0.25 ± 0.02 mm)
0.020" ± 0.001" (0.50 ± 0.03 mm)	0.025" ± 0.001" (0.64 ± 0.03 mm)	0.025" ± 0.001" (0.64 ± 0.03 mm)
0.030" ± 0.0015" (0.75 ± 0.04 mm)	0.050" ± 0.002" (1.27 ± 0.05 mm)	0.050" ± 0.002" (1.27 ± 0.05 mm)
0.060" ± 0.003" (1.52 ± 0.08 mm)		

Standard Claddings

1/2 oz (17 µm) electrodeposited foil
1 oz (35 µm) electrodeposited foil
2 oz (70 µm) electrodeposited foil

Standard Panel Sizes

The standard panel size is 24" X 18". (620 X 457 mm). and 12 X 18" (305 X 457 mm).

RO3000, RO3003, RO3006, and RO3010 are licensed trademarks of Rogers Corporation for its microwave laminate.

These products may require an export license issued by the United States Department of Commerce for export of these materials from the United States or Canada.

The information and guidelines contained in this document are intended to assist you in designing with RO3000 High Frequency Circuit Materials. They do not create any warranties express or implied, including any warranty of merchantability or fitness for a particular purpose. Results may vary as conditions and equipment vary. The user should determine the suitability of Rogers materials for each application. Values are averages and not guaranteed.



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