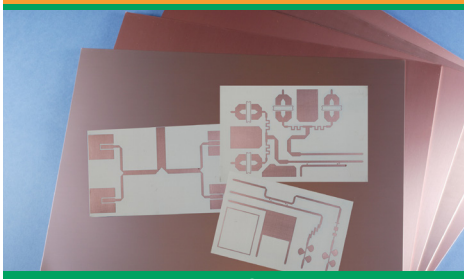
ROGERS CORPORATION

Data Sheet

RO3000® Series Circuit Materials

RO3003™, RO3006™, RO3010™ and RO3035™ 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 ceramic-filled PTFE based 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.

RO3000 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. The dielectric constant versus temperature for RO3003™ and RO3035™ materials is very stable (Chart 1).

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."

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

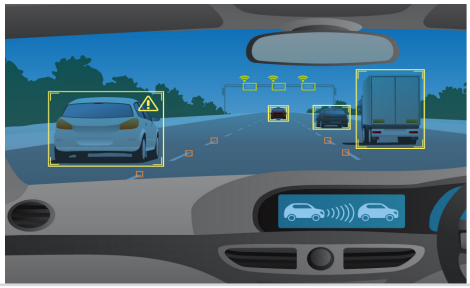


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Chart 1: RO3003 and RO3035 Laminate Dielectric Constant vs. Temperature

The data in Chart 1 demonstrates the excellent stability of dielectric constant over temperature for RO3003 & RO3035 laminates, including the elimination of the step change in dielectric constant, which occurs near room temperature with PTFE glass materials.
The data in Chart 2 shows the

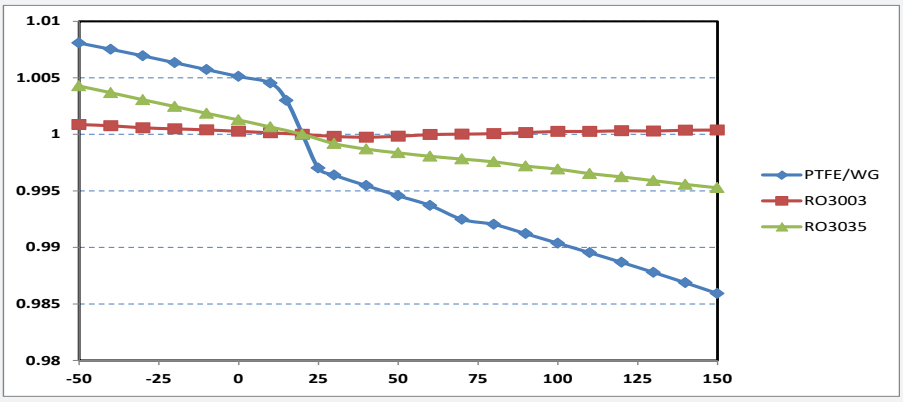


Chart 2: RO3003 and RO3035 Dissipation Factor

distribution of dissipation factor for RO3003 and RO3035 materials.

Test Method: IPC-TM-650 2.5.5.5
Condition: 10 GHz 23° C

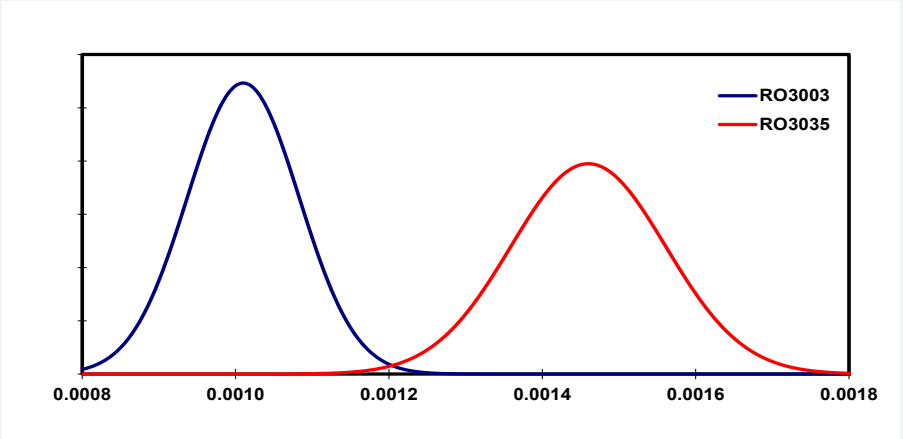
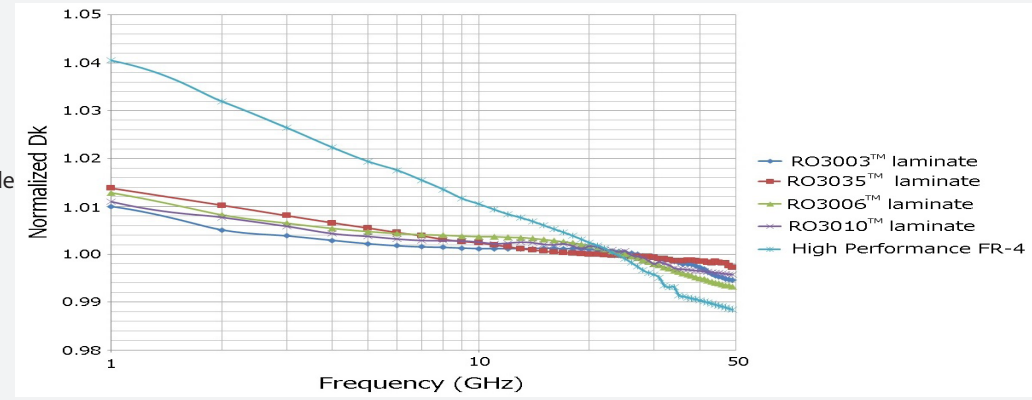


Chart 3: Normalized Dk vs. Frequency using microstrip differential phase length method 50 ohm microstrip circuits based on ~20mil thick laminates

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.



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Property	Typical Value[1]				Direction	Unit	Condition	Test Method
	RO3003	RO3035	RO3006	RO3010				
Dielectric Constant, ε_r Process	3.00 ± 0.04	3.50 ± 0.05	6.15 ± 0.15	10.2 ± 0.30	Z	-	10 GHz 23°C	IPC-TM-650 2.5.5.5 Clamped Stripline
[2] Dielectric Constant, ε_r Design	3.00	3.60	6.50	11.20	Z	-	8 GHz - 40 GHz	Differential Phase Length Method
Dissipation Factor, tan δ	0.0010	0.0015	0.0020	0.0022	Z	-	10 GHz 23°C	IPC-TM-650 2.5.5.5
Thermal Coefficient of ε_r	-3	-45	-262	-395	Z	ppm/°C	10 GHz -50 to 150°C	IPC-TM-650 2.5.5.5
Dimensional Stability	-0.06 0.07	-0.11 0.11	-0.27 -0.15	-0.35 -0.31	X Y	mm/m	COND A	IPC TM-650 2.2.4
Volume Resistivity	10^7	10^7	10^5	10^5		MΩ•cm	COND A	IPC 2.5.17.1
Surface Resistivity	10^7	10^7	10^5	10^5		MΩ	COND A	IPC 2.5.17.1
Tensile Modulus	930 823	1025 1006	1498 1293	1902 1934	X Y	MPa	23°C	ASTM D638
Moisture Absorption	0.04	0.04	0.02	0.05	-	%	D48/50	IPC-TM-650 2.6.2.1
Specific Heat	0.9		0.86	0.8		J/g/K		Calculated
Thermal Conductivity	0.50	0.50	0.79	0.95	-	W/m/K	50°C	ASTM D5470
Coefficient of Thermal Expansion (-55 to 288 °C)	17 16 25	17 17 24	17 17 24	13 11 16	X Y Z	ppm/°C	23°C/50% RH	IPC-TM-650 2.4.41
Td	500	500	500	500		°C TGA		ASTM D3850
Density	2.1	2.1	2.6	2.8		gm/cm^3	23°C	ASTM D792
Copper Peel Strength	12.7	10.2	7.1	9.4		lb/in	1 oz. EDC After Solder Float	IPC-TM-2.4.8
Flammability	V-0	V-0	V-0	V-0				UL 94
Lead Free Process Compatible	YES	YES	YES	YES				

RoHS Compliant

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/techub

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Standard Thicknesses	Standard Panel Sizes	Standard Claddings
RO3003: 0.005" (0.13mm) +/- 0.0005" 0.010" (0.25mm) +/- 0.0007" 0.020" (0.51mm) +/- 0.0010" 0.030" (0.76mm) +/- 0.0015" 0.060" (1.52mm) +/- 0.0030" **RO3006/RO3010:** 0.005" (0.13mm) +/- 0.0005" 0.010" (0.25mm) +/- 0.0007" 0.025" (0.64mm) +/- 0.0010" 0.050" (1.28mm) +/- 0.0020" **RO3035** 0.010" (0.25mm) +/- 0.0005" 0.020" (0.51mm) +/- 0.0010" 0.060" (1.52mm) +/- 0.0030" *Additional non-standard thicknesses available from 0.005: - 0.195" in increments of 0.005"	**RO3003/RO3006/RO3010/RO3035:** 12" X 18" (305 X 457mm) 24" X 18" (610 X 457mm) **RO3003 0.005" and 0.010":** 12" X 18" (305 X 457mm) 24" X 18" (610 X 457mm) 24" X 21" (610 X 533mm) *Additional panel sizes available	**RO3003:** Electrodeposited Copper Foil ½ oz. (18µm) (HH/HH) 1 oz. (35µm) (H1/H1) Rolled Copper Foil ½ oz. (18µm) (AH/AH) 1 oz. (35µm) (A1/A1) **RO3006/RO3010/RO3035:** Electrodeposited Copper Foil ½ oz. (18µm) (HH/HH) 1 oz. (35µm) (H1/H1) *Additional claddings, such as heavy metal, resistive foil and unclad are available

*Contact Customer Service or Sales Engineering to inquire about additional available product configurations

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