RF-35TC

Thermally Conductive Low Loss Laminate

Your Dreams, Our Challenge

Benefits

- "Best in Class" Loss Tangent
- Exceptional Thermal Management
- Dk Stability Across a Broad Temperature Range
- Enhanced Antenna Gains/Efficiencies
- Excellent Adhesion to Very Low Profile copper

Applications

- Filters, Couplers & Power
- Amplifiers
- Antennas
- Satellites

RF-35TC offers a "best in class" low dissipation factor with high thermal conductivity. This material is best suited for high power applications where every 1/10th of a dB is critical and the PWB substrate is expected to diffuse heat away from both transmission lines and surface mount components such as transistors or capacitors. RF-35TC is a PTFE based, ceramic filled fiberglass substrate. It will not oxidize, yellow or show upward drift in dielectric constant and dissipation factor like its synthetic rubber (hydrocarbon) competitors.

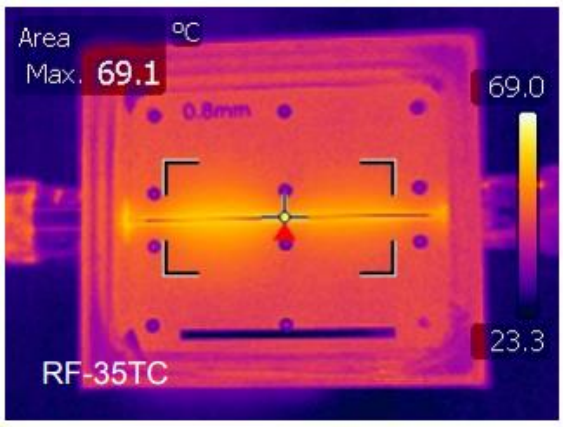
The low Z axis CTE and temperature stable Dk are critical for both narrow band and broad band overlay couplers. The low X and Y CTE values are crucial for maintaining critical distances between trace elements in a printed filter. The extremely low Df of 0.0011 and high thermal conductivity are particularly suited for power amplifier applications.

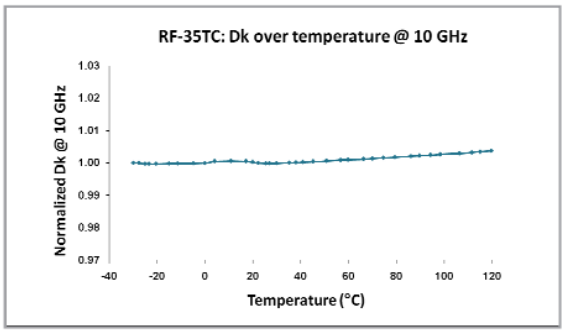
RF-35TC bonds very well to low profile copper, further reducing insertion loss.

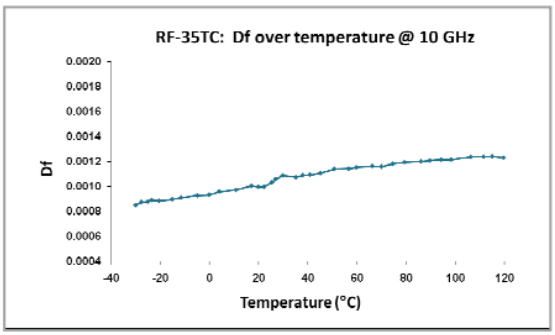
Like most material properties, there are many techniques for measuring thermal conductivity. Thermal conductivity measured on an unclad sample (no copper) offers the true thermal conductivity of the laminate. Measurements on a copper clad laminate typically yield higher values as the copper clad laminate offers the least thermal resistance at the interface between the laminate and measuring equipment.

When measured with or without copper cladding, RF-35TC has a state-of-the-art thermal conductivity. However, the low dissipation factor differentiates RF-35TC from the competition.

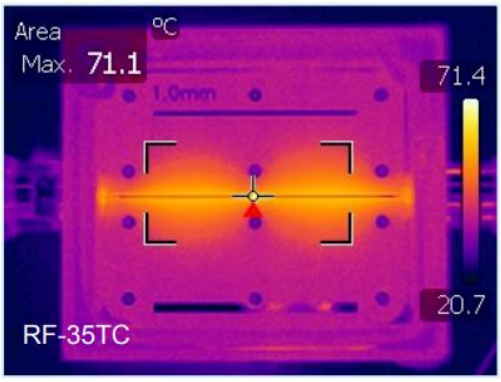
Thermal image of 0603 capacitor at the center of a microstrip (47pF/250V/C0G) assembled on RF-35TC under 200 watts applied power.



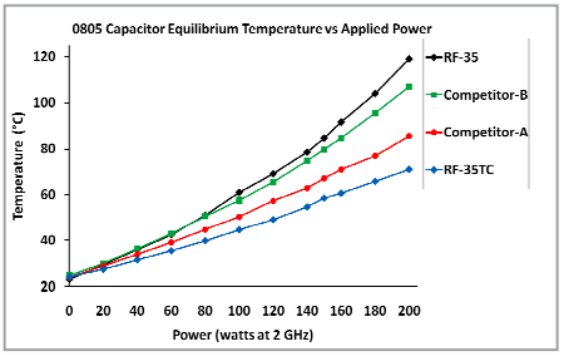




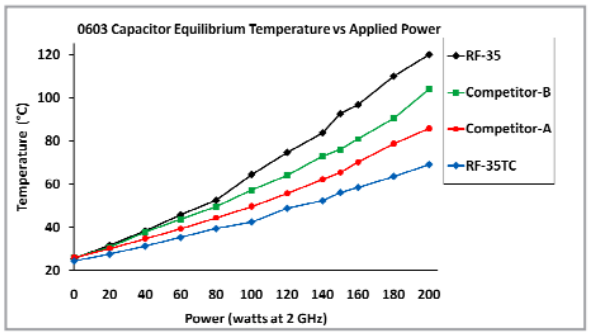
RF-35TC offers superior heat dissipation performance compared to competitive materials through a combination of exceptional thermal conductivity and "best in class" low dielectric loss.



Thermal image of a microstrip transmission line with 0805 capacitor at center (47pF/250V/C0G) assembled on RF-35TC under 200 watts applied power.

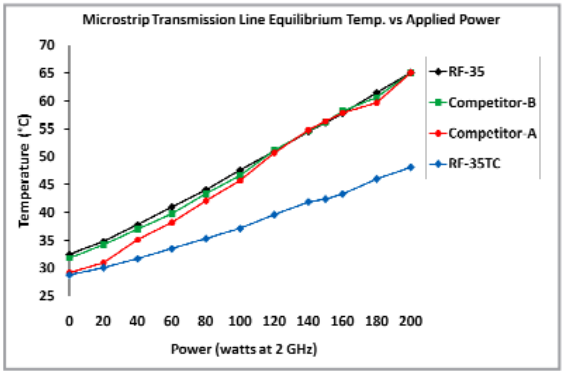


Maximum temperature as a function of applied power for a microstrip and 0805 capacitor assembled on RF-35TC, RF-35 and two competitive materials.



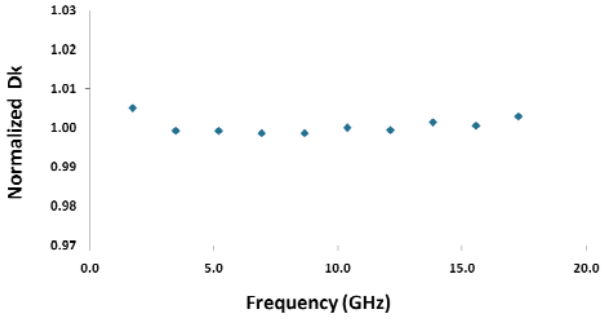
Maximum temperature as a function of applied power for a microstrip and 0603 capacitor assembled on RF-35TC, RF-35 and two competitive materials.

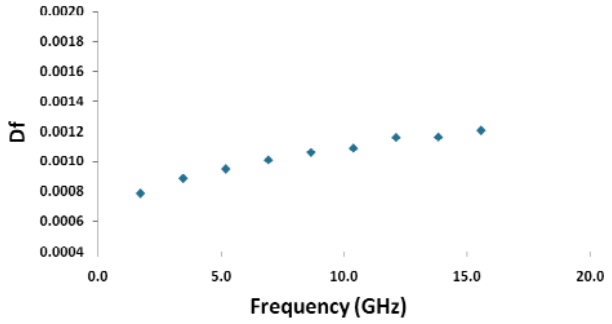
RF-35TC : normalized Dk vs frequency



Maximum temperature as a function of applied power for a microstrip transmission line assembled on RF-35TC, RF-35 and two competitive materials.

Rf-35TC : Df vs frequency





Properties	Conditions	Typical Value	Unit	Test Method
Electrical Properties				
Dielectric Constant	@ 10 GHz	3.5 ± 0.05		IPC-650 2.5.5.5.1 (Modified)
Dissipation Factor	@ 10 GHz	0.002		IPC-650 2.5.5.5.1 (Modified)
Surface Resistivity		8.33×10^7	Mohms	IPC-650 2.5.17.1 (After Elevated Temp.)
		6.42×10^7	Mohms	IPC-650 2.5.17.1 (After Humidity)
Volume Resistivity		5.19×10^8	Mohms/cm	IPC-650 2.5.17.1 (After Elevated Temp.)
		2.91×10^8	Mohms/cm	IPC-650 2.5.17.1 (After Humidity)
Thermal Properties				
Thermal Conductivity	Unclad, 125 °C	0.60	W/M*K	ASTM F433 (Guarded Heat Flow)
	C1/C1, 125 °C	0.92	W/M*K	
	CH/CH, 125 °C	0.87	W/M*K	
CTE (23 to 125 °C)	X	11	ppm/°C	IPC-650 2.4.41 / ASTM D 3386
	Y	13		
	Z	34		
T_d	2% Wt. Loss	420 (788)	°C (°F)	IPC-650 2.4.24.6/TGA
	5% Wt. Loss	436 (817)	°C (°F)	
Mechanical Properties				
Peel Strength	½ oz CVH	1.25 (7.0)	N/mm (lbs/in)	IPC-650 2.4.8 (Thermal Stress)
Dielectric Strength		22,441 (570)	V/mm (V/mil)	ASTM D 149 (Through Plane)
Flexural Strength	MD	88.94 (12,900)	N/mm^2 (psi)	ASTM D 790 / IPC-650 2.4.4
	CD	80.67 (11,700)	N/mm^2 (psi)	
Tensile Strength	MD	62.19 (9,020)	N/mm^2 (psi)	ASTM D 3039 / IPC-TM-650 2.4.19
	CD	53.37 (7,740)	N/mm^2 (psi)	
Elongation at Break	MD	1.89	%	ASTM D 3039 / IPC-TM-650 2.4.19
	CD	1.70	%	
Young's Modulus	MD	4,599 (667,000)	N/mm^2 (psi)	ASTM D 3039 / IPC-TM-650 2.4.19
	CD	4,392 (637,000)	N/mm^2 (psi)	
Poisson's Ratio	MD	0.18		ASTM D 3039 / IPC-TM-650 2.4.19
	CD	0.23		
Dimensional Stability	MD	0.23	mm/M (mils/in)	IPC-650-2.4.39 Sec. 5.4 (After Etch)
	CD	0.64	mm/M (mils/in)	
Dimensional Stability	MD	-0.04	mm/M (mils/in)	IPC-650-2.4.39 Sec. 5.5 (Thermal Stress)
	CD	0.46	mm/M (mils/in)	
Chemical / Physical Properties				
Flammability			V-0	UL-94
Specific Heat		0.94	j/(g °C)	IPC-650 2.4.50
Density		2.35	g/cm^3	IPC-650 2.3.5
Dielectric Breakdown		56.7	kV	IPC-650 2.5.6 (In-Plane,Two Pins in Oil)
Moisture Absorption		0.05	%	IPC-650 2.6.2.1
Arc Resistance		304	seconds	IPC-650 2.5.1
Hardness		79.1	%	ASTM D 2240 (Shore D)

Typical Thicknesses			
Inches	**mm**	**Inches**	**mm**
0.0050	0.13	0.0300	0.76
0.0100	0.25	0.0600	1.52
0.0200	0.51		

Available Sheet Sizes			
Inches	**mm**	**Inches**	**mm**
12 x 18	305 x 457	18 x 24	406 x 914

16 x 18	406 x 457	16 x 36	610 x 914
18 x 24	457 x 610		

* All test data provided are typical values and not intended to be specification values. For review of critical specification tolerances, please contact a company representative directly.
* RF-35TC can be manufactured in increments of 0.005”(0.125mm).
* Standard panel size is 18” x 24” (457 mm x 610 mm).
* Please contact AGC for availability of additional thicknesses, other sizes & any other type of cladding.

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