ROGERS CORPORATION

\\\ Datasheet

AD Series™ Antenna Materials

AD250C™, AD255C™, AD300D™and AD350A™ Laminate Materials

The AD Series™ antenna materials from Rogers Corporation are high performance, specialty materials that are specifically engineered and manufactured to meet the demands of today's wireless antenna markets. Rogers has the materials needed to meet these design needs both today and into the future.

The AD Series antenna products are glass-reinforced, PTFE based materials that provide controlled dielectric constant, low loss performance, and very good passive intermodulation (PIM) performance. The woven glass reinforcement affords good circuit processability and enables high yield circuit board fabrication.

The AD Series antenna products are manufactured with many dielectric constant options to meet the wide variety of needs for today's antenna requirements. These options and tight control help to enable the circuit to meet the desired impedance every time.

All AD Series antenna products are offered with standard electrodeposited (ED) or reverse treated ED copper foil options. This provides choices that are sufficient to help reduce both circuit losses and antenna PIM.

Lastly, as PTFE based composites, the AD Series antenna materials have very low loss (typically less than 0.002 at 10 GHz), very low moisture absorption (less than 0.1%), and very high copper peel strength (greater than 10 pli).

These features combined together make the AD Series laminates an ideal choice for antenna applications.

\\\ Features and Benefits:

Low loss tangent (<0.002 at 10 GHz)

- Excellent circuit performance in all typical wireless frequency bands

Controlled dielectric constant (±0.05)

- • Repeatable circuit performance

Very low PIM (-159 dBc at 30 mil, 1900 MHz)

- Excellent antenna performance and reduced yield loss due to PIM related issues

Excellent dimensional stability

- Repeatable circuit performance and improved manufacturing yields

\\\ Typical Applications:

- Cellular infrastructure base station antenna
- Automotive telematics antenna systems
- Commercial satellite radio antenna

\\\ Standard Properties Table

Properties	Typical Values[1] AD250C	Typical Values[1] AD255C	Units	Test Conditions		Test Method
Electrical Properties						
Dielectric Constant (process)	2.52	2.55	-	23˚C @ 50% RH	10 GHz	IPC TM-650 2.5.5.5
Dielectric Constant (design)	2.50	2.60	-	C-24/23/50	10 GHz	Microstrip Differential Phase Length
Dissapation Factor	0.0013	0.0013	-	23˚C @ 50% RH	10 GHz	IPC TM-650 2.5.5.5
Thermal Coefficient of Dielectric Constant	-117	-110	ppm/˚C	0 to 100˚C	10 GHz	IPC TM-650 2.5.5.5
Volume Resistivity	4.8×10^8	7.4×10^8	MΩ-cm	C96/35/90	-	IPC TM-650 2.5.17.1
Surface Resistivity	4.1×10^7	3.6×10^7	MΩ	C96/35/90	-	IPC TM-650 2.5.17.1
Electrical Strength (dielectric strength)	979	911	V/mil		-	IPC TM-650 2.5.6.2
Dielectric Breakdown	>40	>40	kV	D-48/50	X/Y direction	IPC TM-650 2.5.6
PIM[2]	-159/-163	-159/-163	dBc	Reflected 43 dBm swept tones at 1900 MHz, S1/S1		Rogers Internal 50 ohm
Thermal Properties						
Decomposition Temperature (Td)	>500	>500	˚C	2hrs @ 105˚C	5% Weight Loss	IPC TM-650 2.3.40
Coefficient of Thermal Expansion - x	47	34	ppm/˚C	-55˚C to 288˚C		IPC TM-650 2.4.41
Coefficient of Thermal Expansion - y	29	26	ppm/˚C			IPC TM-650 2.4.41
Coefficient of Thermal Expansion - z	196	196	ppm/˚C			IPC TM-650 2.4.41
Thermal Conductivity	0.33	0.35	W/(m·K)	-	z direction	ASTM D5470
Time to Delamination	>60	>60	minutes	as-received	288˚C	IPC TM-650 2.4.24.1
Mechanical Properties						
Copper Peel Strength	2.6 (14.8)	2.4 (13.6)	N/mm (lbs/in)	10s @288˚C	35 µm foil	IPC TM-650 2.4.8
Flexural Strength (MD/CMD)	60.7/44.1 (8.8/6.4)	60.7/44.1 (8.8/6.4)	MPa (ksi)	25°C ± 3°C	-	ASTM D790
Tensile Strength (MD, CMD)	41.4/38.6 (6.0/5.6)	55.8/45.5 (8.1/6.6)	MPa (ksi)	23˚C @ 50% RH	-	ASTM D3039/D3039-14
Flex Modulus	6,102/5,364 (885/778)	6,412/5,640 (930/818)	MPa (ksi)	25°C ± 3°C	-	IPC-TM-650 2.4.4
Dimensional Stability (MD, CMD)	0.02/0.06	0.03/0.07	mils/inch	after etch + bake	-	IPC-TM-650 2.4.39a
Physical Properties						
Flammability	V-0	V-0	-	-	-	UL 94
Moisture Absorption	0.04	0.03	%	E1/105 +D48/50	-	IPC TM-650 2.6.2.1
Density	2.28	2.28	g/cm^3	C24/23/50	-	ASTM D792
Specifc Heat Capacity	0.813	0.813	J/g˚K	2 hours at 105˚C	-	ASTM E2716

[1] Typical values are a representation of an average value for the population of the property. For specification values contact Rogers Corp.
[2] PIM Performance is heavily influenced by the copper choice. PIM values provided are typical values based on testing of the S1 foil using Rogers' internal test method on 0.030" thick and 0.060" thick laminates.
Rogers recommends the customer evaluate each material and design combination to determine fitness for use over the entire life of the end product

\\\ Standard Properties Table

Properties	Typical Values[1] AD300D	Typical Values[1] AD350A	Units	Test Conditions		Test Method
Electrical Properties						
Dielectric Constant (process)	2.97	3.54	-	23˚C @ 50% RH	10 GHz	IPC TM-650 2.5.5.5
Dielectric Constant (design)	2.94	3.50	-	C-24/23/50	10 GHz	Microstrip Differential Phase Length
Dissapation Factor	0.0021	0.0033	-	23˚C @ 50% RH	10 GHz	IPC TM-650 2.5.5.5
Thermal Coefficient of Dielectric Constant	-73	-57	ppm/˚C	0 to 100˚C	10 GHz	IPC TM-650 2.5.5.5
Volume Resistivity	1.7 x 10^8	1.5 x 10^9	MΩ-cm	C96/35/90	-	IPC TM-650 2.5.17.1
Surface Resistivity	5.1 x 10^7	9.5 x 10^7	MΩ	C96/35/90	-	IPC TM-650 2.5.17.1
Electrical Strength (dielectric strength)	750	671	V/mil	-	-	IPC TM-650 2.5.6.2
Dielectric Breakdown	46	33	kV	D-48/50	X/Y direction	IPC TM-650 2.5.6
PIM[2]	-159/-163	-159/-163	dBc	Reflected 43 dBm swept tones at 1900 MHz, S1/S1		Rogers Internal 50 ohm
Thermal Properties						
Decomposition Temperature (Td)	>500	>500	˚C	2hrs @ 105˚C	5% Weight Loss	IPC TM-650 2.3.40
Coefficient of Thermal Expansion - x	24	18	ppm/˚C	-55˚C to 288˚C		IPC TM-650 2.4.41
Coefficient of Thermal Expansion - y	23	18	ppm/˚C			IPC TM-650 2.4.41
Coefficient of Thermal Expansion - z	98	63	ppm/˚C			IPC TM-650 2.4.41
Thermal Conductivity	0.37	0.44	W/(m·K)	-	z direction	ASTM D5470
Time to Delamination	>60	>60	minutes	as-received	288˚C	IPC TM-650 2.4.24.1
Mechanical Properties						
Copper Peel Strength	2.6 (14.8)	2.4 (13.6)	N/mm (lbs/in)	10s @288˚C	35 µm foil	IPC TM-650 2.4.8
Flexural Strength (MD/CMD)	152.4/127.6 (22.1/18.5)	97.9/62.1 (14.2/9.0)	MPa (ksi)	25°C ± 3°C	-	ASTM D790
Tensile Strength (MD, CMD)	122.0/120.7 (17.7/17.5)	97.9/46.2 (14.2/6.7)	MPa (ksi)	23˚C @ 50% RH	-	IASTM D3039/D3039-14
Flex Modulus	10,400/9,580 (1510/1390)	12,652/10,128 (1,835/1,469)	MPa (ksi)	25°C ± 3°C	-	IPC-TM-650 2.4.4
Dimensional Stability (MD, CMD)	-0.08/0.02	0.15/0.17	mils/inch	after etch + bake	-	IPC-TM-650 2.4.39a
Physical Properties						
Flammability	V-0	V-0	-	-	-	UL 94
Moisture Absorption	0.04	0.1	%	E1/105 +D48/50	-	IPC TM-650 2.6.2.1
Density	2.23	2.43	g/cm^3	C24/23/50	-	ASTM D792
Specifc Heat Capacity	0.80	0.757	J/g˚K	2 hours at 105˚C	-	ASTM E2716

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Rogers recommends the customer evaluate each material and design combination to determine fitness for use over the entire life of the end product

\\\ Standard Offerings

Standard Thicknesses	Standard Panel Sizes	Standard Claddings
AD250C 0.020" (0.508 mm) +/- 0.002" 0.030" (0.762 mm) +/- 0.002" 0.060" (1.524 mm) +/- 0.003" **AD255C** 0.020" (0.508 mm) +/- 0.002" 0.030" (0.762 mm) +/- 0.002" 0.040" (1.016 mm) +/- 0.002" 0.060" (1.524 mm) +/- 0.002" 0.125" (3.175 mm) +/- 0.006" **AD300D** 0.030" (0.762 mm) +/- 0.002" 0.040" (1.016mm) +/- 0.002" 0.060" (1.524 mm) +/- 0.002" 0.120" (3.048 mm) +/- 0.006" **AD350A** 0.030" (0.762 mm) +/- 0.002" 0.060" (1.524 mm) +/- 0.003" 0.120" (3.048 mm) +/- 0.006"	**AD250C .020":** 18" x 12" (457mm x 305mm) 18" x 24" (457mm x 610mm) **All Other Thicknesses** 12" X 18" (305 X 457 mm) 24" X 18" (610 X 457 mm)	Electrodeposited Copper Foil ½ oz. (18µm) 1oz. (35µm) Reverse Treated Electrodeposited Copper Foil ½ oz. (18µm) 1oz. (35µm)

*Contact Customer Service or Sales Engineering to inquire about other available product configurations including additional thicknesses, panel sizes and claddings.

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